

AAI AUTOMOTIVE INDUSTRIES

AUTOMOTIVE and AVIATION MANUFACTURING

Civilian and Defense

JULY 1, 1951

In This Issue . . .

Military Vehicle Development

Swing Type Intake Valves

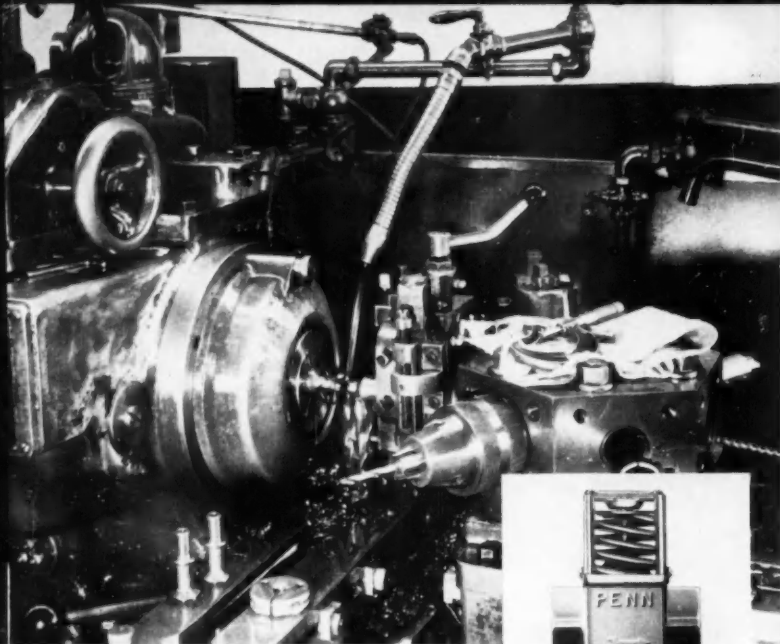
Highlights of Gear Makers Meeting

Jet Engine Inducer Techniques

Volume Production of Car Upholstery

Complete Table of Contents, Page 3

A C H I L T O N P U B L I C A T I O N



Above—View of turret lathe operation employed by Penn Electric Switch Co. to produce parts for water regulator. Right—Exterior view of the Penn Type 246 Water Regulator for water cooled refrigeration compressors.



Still at the head of the cutting oil class...

THE tests began more than six years ago. At that time, operators of the Penn Electric Switch Company of Goshen, Indiana, were seeking a cutting oil best suited to a variety of lathe operations on monel metal, various grades of steel, and other ferrous metals. Among the oils tested was STANICUT Oil 155CS recommended by a Standard Oil lubrication specialist.

All cutting oils were put through the same exacting tests.

STANICUT came out ahead, performing the most satisfactory job on each operation. Its versatility convinced plant operators that it could handle a wide range of jobs in their lathe department.

For example, production of one monel metal part for Penn Electric's Type 246 Water Regulator includes drilling, forming, and threading... with STANICUT assuring long tool life and fine finish.

From time to time during the past six

years, other cutting oils have been tested against STANICUT. STANICUT is still at the head of the cutting oil class.

This company's experience with the advantages of STANICUT can be your plant's experience too. And you can profit further through the engineering services of a Standard Oil lubrication specialist. See at the right how to avail yourself of his services.

Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Ill.



What's YOUR problem?



If your plant is located near South Bend, here is a man you ought to know. He's E. O. Smith, lubrication specialist in Standard Oil's office in that city. Mr. Smith recommended STANICUT Oil 155CS for use in the Penn Electric Switch Plant, thus helping that company find the very cutting oil they were looking for.

Mr. Smith and other able lubrication specialists are located in Standard offices throughout the Midwest. They have been specially trained in a Standard Oil Lubrication Engineering School and in addition have a wealth of on-the-job experience. The specialist nearest your plant is ready to give prompt, expert, thorough attention to your lubrication needs.

It's easy to obtain his services. A phone call or letter to your nearest Standard Oil Company (Indiana) office will bring him quickly to your plant... with no obligation to you, of course. He'll explain to you the advantages of many fine Standard products, among them...

STANICOOL HD Soluble Oil—Because it contains additional compounding, this soluble oil possesses not only the cooling ability of an emulsion but also the ability to give better tool life and finer finishes than can be obtained with a conventional soluble oil.

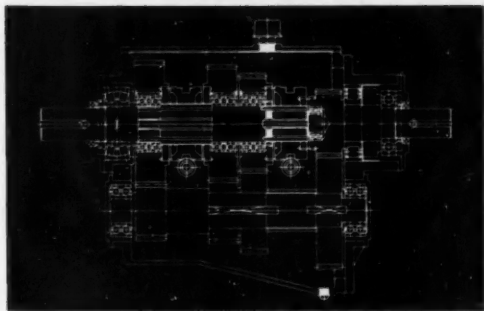
STANOSTAMP Compounds—Here are three established products for stamping or heavy drawing operations of either low-carbon or alloy steels. Water can be added to these paste compounds to provide the most economical application. STANOSTAMPS offer maximum protection for dies and work. These compounds can be readily removed in conventional washing equipment.



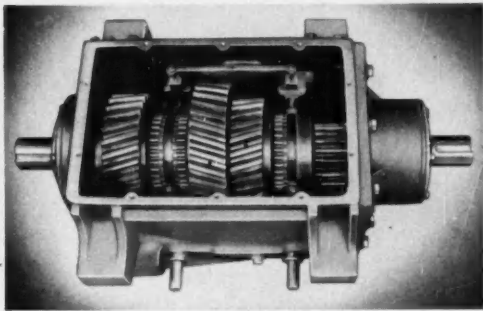
STANDARD OIL COMPANY (INDIANA)

Engineered TO ORDER

FOR LOCOMOTIVES MADE BY
VULCAN IRON WORKS, WILKES-BARRE, PA.



COTTA engineers developed the above transmission to meet Vulcan's specific requirements — fit available space — assure ease of installation and mounting — provide a durable unit.



Precision-designed, this four-speed midship type constant-mesh transmission (shown with cover removed) gives Vulcan locomotives the gearbox stamina needed for constant push and pull.



Eight hours a day, this 20-ton Vulcan locomotive hauls trains of rock from quarry to rock-crushing plant . . . typical of Vulcan locomotives operating steadily under a wide variety of industrial track-haulage conditions. To get the necessary "guts in the gearbox", Vulcan has been coming to COTTA for more than 25 years . . . for smooth, low-cost transmission of power.

COTTA TRANSMISSION CO., ROCKFORD, ILLINOIS



COTTA

HEAVY-DUTY
TRANSMISSIONS

PRECISION-BUILT • SPECIALLY
ENGINEERED FOR YOUR PRODUCT



- The widespread use of triple-alloy steels containing Nickel, chromium and molybdenum is based on extensive experience in widely divergent engineering fields.

It has been found that they can be counted on for consistent performance. The depth to which full hardness is developed is comparable to that attained by other alloy steels. Their response to heat treatment is dependably uniform.

Moreover, the wide range of compositions available, makes it possible to select *accurately* suitable alloy steels for a broad range of applications.

Inquiries regarding the selection and uses of triple-alloy steels containing Nickel are invited.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street
New York 5, N. Y.

AUTOMOTIVE INDUSTRIES

Published Semi-Monthly

July 1, 1951

Vol. 105, No. 1

Contents

High Spots of This Issue	15
News of the Automotive Industries	17
Men in the News	25
Upholstery Requires 700 Operations	32
Military Vehicle Developments and Other Highlights of the SAE Summer Meeting.	
By James R. Custer	34
Metals. By William F. Boericke	39
Latest Warplane Designs	40
Wide Variety of Universal Joints on the Production Line. By Joseph Geschelin	42
Swing Type Intake Valves. By W. F. Bradley	45
Manual Handling Reduced on Waukesha Engine Assembly Lines	46
LPG as a Motor Fuel	48
Gear Makers Hold Annual Meeting and Elect Officers. By Thomas MacNew	50
Checking V-8 Crankshaft by Air Gaging Method	53
Making Jet Aircraft Inducers an Exact Process. By Joseph Geschelin	54
Compact Countersink Tool Developed at Boeing	56
Compact Electronic Computer	56
New Chemical Bath "Blasts" Scale from Forgings	57
New Production and Plant Equipment	58
New Products	62
Publications Available	64
New Products for Aircraft	85
Calendar of Coming Events	92
Advertisers' Index	122

Copyright 1951 by Chilton Company (Inc.)

One of the Publications Owned by

① CHILTON COMPANY (INC.) ①

Executive Offices

Chestnut and 56th Streets, Philadelphia 39, Pa., U. S. A.

Officers and Directors

Jos. S. Hildreth, President

Vice-Presidents

EVERIT B. TERHUNE

P. M. FAHRENDORF

G. O. BUZBY

HARRY V. DUFFY

WILLIAM H. VALLAR, Treasurer

JOHN BLAIR MOFFETT, Secretary

MAURICE E. COX

GEORGE T. HOOK

L. V. ROWLANDS

TOM C. CAMPBELL

FRANK P. TIGHE

GEORGE MAISWINKLE, Asst. Treas.

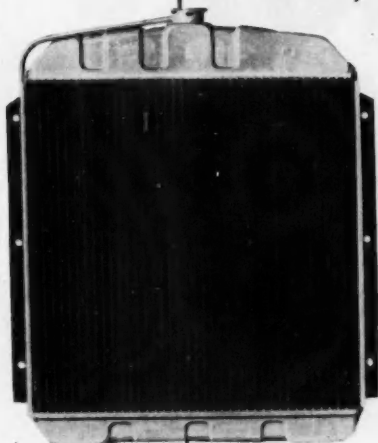
Member: Audit Bureau of Circulations

AUTOMOTIVE INDUSTRIES is a consolidation of The Automobile (weekly) and the Motor Review (weekly), May, 1937; Dealer and Repairman (monthly), October, 1937; the Automobile Magazine (monthly), July, 1937, and the Horseless Age (weekly), founded in 1895, Mar. 1918.

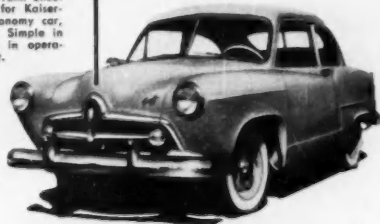
AUTOMOTIVE INDUSTRIES, Vol. 105, No. 1. Published semi-monthly by Chilton Co., Chestnut & 56th Sts., Phila. 39. Entered as Second Class Matter October 1, 1925, at the Post Office at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. In case of Non-Delivery Return Postage Guaranteed. Subscription price: United States, Mexico, United States Possessions, and all Latin-American countries, 1 year \$2.00, 2 years \$3.00. Canadian and Foreign \$5.00 per year; single copies, 25 cents, except Statistical Issue (Mar. 1951), \$1.00.

AUTOMOTIVE INDUSTRIES, July 1, 1951

YOUNG PROVIDES ECONOMY-SIZE COOLING, TOO!



Young Stamped Tank Sheet Metal Radiator for Kaiser-Frazer's new economy car, the "Henry J." Simple in design, efficient in operation, low in cost.



(Right) Kaiser-Frazer's New "Henry J."

Modern automotive engineering tends toward compact, efficient cooling—the utmost in heat transfer per pound of radiator weight. That's why Young is especially proud to reveal its contributions to the efficient, economical operation of America's smaller passenger cars. Young engineering soundness has been proved, too, on some of the Nation's largest over-the-road and earth-moving equipment. Let Young engineer your next heat transfer requirement; details gladly furnished upon request.

YOUNG

HEAT TRANSFER PRODUCTS FOR
AUTOMOTIVE AND INDUSTRIAL
APPLICATIONS.



HEATING, COOLING, AND AIR
CONDITIONING PRODUCTS FOR
HOME AND INDUSTRY.

T.H. REG. U.S. PAT. OFF.

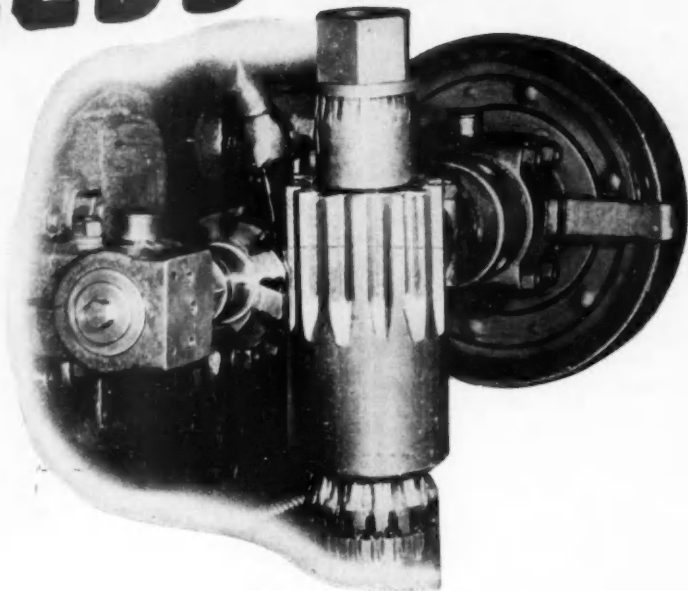
YOUNG RADIATOR COMPANY

DEPT. 101-G, RACINE, WISCONSIN

Plants at Racine, Wisconsin and Matteson, Illinois

MORE PIECES ... LESS COST

**...with Texaco
Cutting Fluids
and Lubrication
Engineering
Service**



YOU GAIN important benefits when you use *Texaco Cutting, Grinding and Soluble Oils* and Texaco Lubrication Engineering Service. For example —

★★**PRODUCTION GOES UP.** Whether cutting or grinding, Texaco cutting fluids both lubricate and cool, eliminate chip welding or wheel loading. You can thus increase speed and feed for greater output, lower unit costs.

★★**TOOLS LAST LONGER.** Tools get full protection with Texaco cutting fluids. You get more cuts per tool grind or wheel dressing; there is less down time

for tool changes, less replacement cost.

★★**FINISH IS IMPROVED.** Greater accuracy and better finish on the original cut mean fewer rejects and save additional operations.

Whatever the metal or your method of machining it, there is a *Texaco Cutting, Grinding or Soluble Oil* to help you do it better, faster, and at lower cost. A Texaco Lubrication Engineer will gladly help you. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street,
New York 17, N. Y.



**TEXACO CUTTING, GRINDING AND
SOLUBLE OILS FOR FASTER
MACHINING**

Here's how you can tell the chain with **SHOT-PEENED** rollers ...



**LOOK FOR THE
DISTINGUISHING
DARKENED ROLLERS**



Thousands of tiny steel balls hammer the metal—"cold work" each roller... pay off in extra fatigue life... added ability to withstand shock and impact.

...the chain that has extra fatigue life

YES, you want to be sure you get shot-peened rollers on the next roller chain you buy. Shot-peening gives rollers the extra fatigue life needed to take repeated shock and impact loads.

These chains are high in tensile strength, durable under severe loads, relatively light in weight and uniform in pitch. This accounts for their wide acceptance throughout industry for both drive and conveying purposes.

Thanks to constant research and precise manufacturing controls, every Link-Belt Precision Steel Roller Chain meets the highest standards for uniform strength. You get a positive, long-life drive—unaffected by heat, cold or moisture.

Link-Belt Roller Chain is available in single or multiple widths, in $\frac{3}{8}$ to 3 in. single and double pitch. For all the facts, call your nearest Link-Belt office.



PRECISION STEEL ROLLER CHAIN



**Easier coupling
and uncoupling without
sacrificing load distribution**

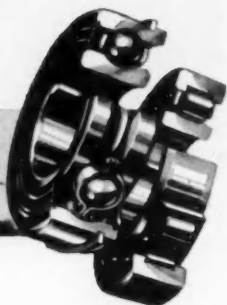
Patented E-Z Assembly feature of Link-Belt Precision Steel Roller Chain has won world-wide approval. Coupling and uncoupling of multiple width chains—right on the job—is far easier. There's absolutely no sacrifice of load distribution... no loss of the chain's remarkable performance. Press-fits between chain pins and middle bars have been modified. But full load carrying capacity across the entire width of the chain has been maintained.

LINK-BELT COMPANY: Indianapolis 6, Chicago 9, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices, Factory Branch Stores and Distributors in principal cities. 12, 332

AUTOMOTIVE INDUSTRIES, July 1, 1951



...“swift
completion
of their
appointed
rounds”



Most motorized nation in the world, America is constantly on the move. And thanks to engineering know-how, it moves on schedule. The giant buses, trucks and trailers that haul countless millions of tons of payloads through heat and cold, rain, snow and sleet, keep to rigid time tables . . . and require only minimum maintenance. SKF cooperates closely with the automotive industry, works with its engineers in developing and producing bearings which meet and even surpass the most rigid requirements, again and again demonstrates time-proved ability to help supply the right bearing in the right place.

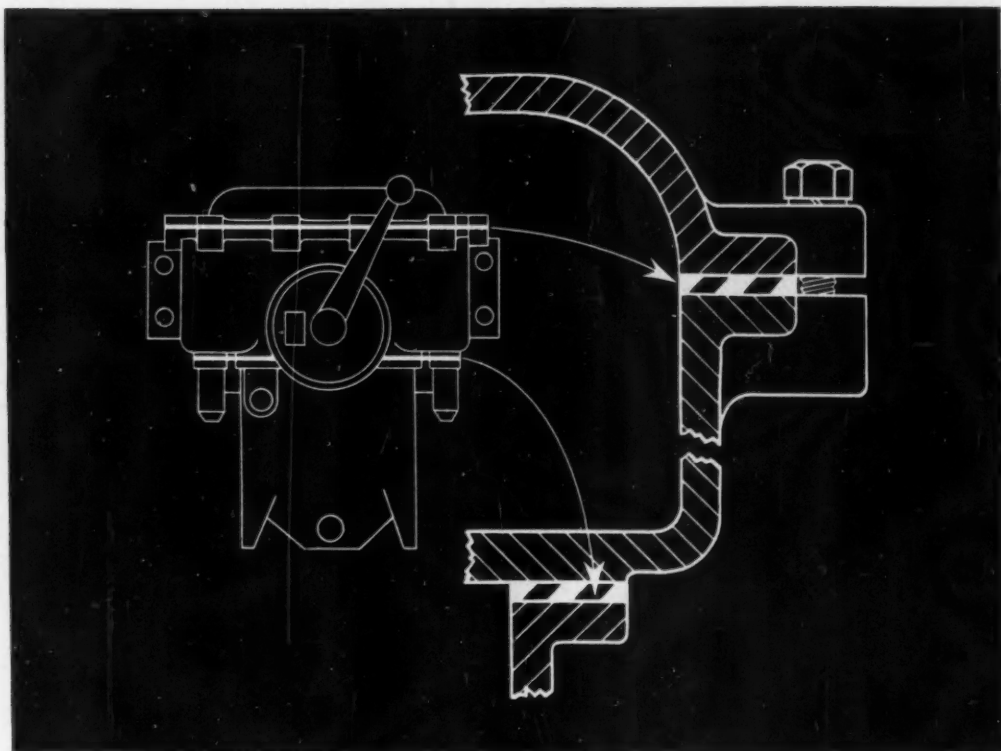
7267



WHY SKF IS PREFERRED BY ALL INDUSTRY

integrity • craftsmanship • metallurgy
tolerance control • surface finish
product uniformity • engineering service
field service

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.—manufacturers of SKF and HESS-BRIGHT bearings.



Check these three factors to insure correct gasket compression

Three common factors may upset expected gasket compression. They are (1) condition of the flange surface, (2) gasket width, and (3) gasket thickness. If gasket choice does not take these factors into account, gasket failure may result.

On clean flanges, for example, the surface friction of straight rubber normally impedes sideflow. If this friction is cut by wet gasket cement or grease, it will upset load estimates based on laboratory tests on dry rubber between non-skid plates. Even a virtually invisible oily film may cause a rubber gasket to sideflow excessively or slip out of position.

This trouble was encountered on the oil-filled circuit breaker shown above. During assembly and maintenance, the straight rubber gasket squeezed out. Substituting a cork-and-rubber gasket eliminated this excessive sideflow and the gasket stayed in place.

Changes in gasket width, depending upon the gasket material, may require changes in unit load to maintain constant compression. An increase in the width of a rubber gasket adds material. This additional material increases internal resistance to flow. To offset this resistance, unit loads must be raised. This is not the case with truly compressible materials such as cork-and-rubber. They do not sideflow appreciably so changes in width have little effect.

Changing gasket thickness may also have an effect on gasket compression. A $\frac{1}{2}$ " straight rubber gasket that compresses about 20% under 280 psi will require almost 1000 psi for the same per cent compression if its thickness is reduced to $\frac{1}{8}$ ". With cork-and-rubber, however, changes in the ratio of load area to free area affect stress-strain curves only slightly. Consequently, it is unnecessary to increase unit loads to maintain constant compression when the thickness of compressible materials is reduced.

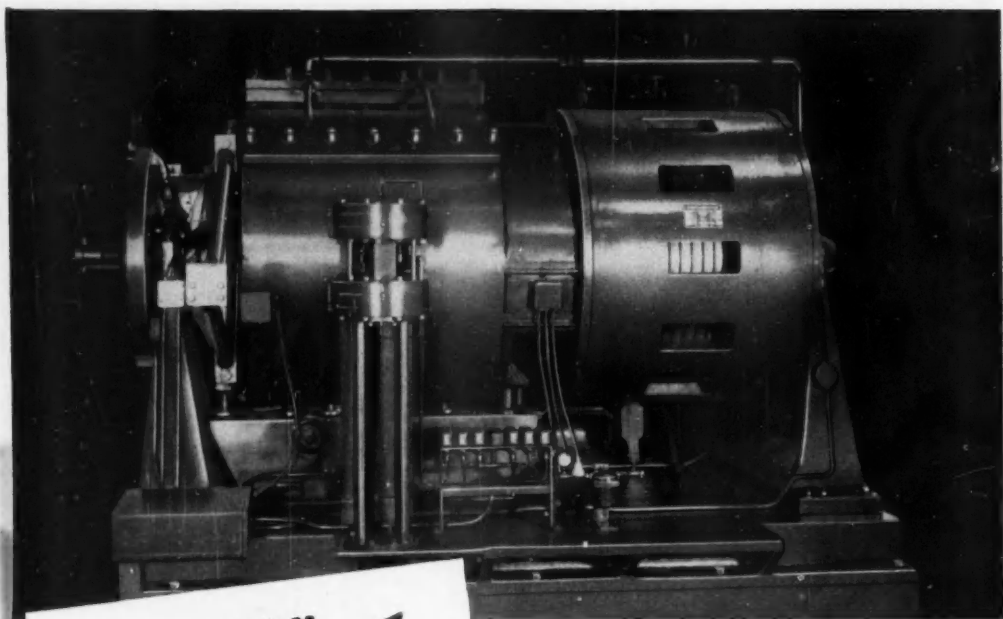
• • •

There is an Armstrong Composition designed to meet each of the six grades in MIL-G-6183 (formerly AN-G-32) covering cork-and-rubber materials. For information on new gasketing materials being developed to meet special military requirements, call your Armstrong representative . . . or write.

See Armstrong's Gasket Materials manual in Sweet's file for product designers for other design suggestions covering both joints and gaskets. For personal copy of this manual, write to the Armstrong Cork Company, Gaskets and Packings Department, 1507 Arch Street, Lancaster, Penna.



ARMSTRONG'S Gasket Materials



EATON
DYNAMATIC
®
DYNAMOMETERS

Accurate
Vibration-Free Readings
at All Speeds

Dynamatic Dynamometers are characterized by extreme smoothness and freedom from vibration, providing quick, accurate readings at all speeds. Convenient, positive control is accomplished with simple, inexpensive, electronic equipment. These units are extremely flexible in operation, and are adaptable to a wide range of conditions, producing very high torques at low speeds, operating easily at high speeds, and offering a smooth and infinitely adjustable range of torque. Completely self-contained A.C. operation.

Dynamatic Dynamometers are extremely simple, compact, light in weight, and moderate in cost. They are available in absorbing, motoring, and universal types. The latter provide for instantaneous switching from absorbing to motoring and back, so that friction horsepower of an engine can be determined at attained operating temperatures.

There are almost unlimited possibilities in horsepower and speed combinations; horsepowers from 5 to 5000; speeds from 100 rpm to 30,000 rpm.

DYNAMATIC
®

CORPORATION

**KENOSHA
 WISCONSIN**

Subsidiary of EATON MANUFACTURING COMPANY, Cleveland, Ohio

Dynamometers	•	Oil Well Draw-Works Brakes	•	Adjustable-Speed Couplings	•	Eddy-Current Brakes
Adjusto-Speeds	•	Shovel Clutches	•	Press Drives	•	Lift Truck Clutches
					•	Electronic Controls



-the COMPLETE LINE with
the right battery for every need

Whatever your product, if it's battery equipped, there's an Exide of the right type, size and capacity to meet your specific needs. Back of each are scores of years of battery-building experience and vast research-engineering laboratories.

The Exide line is *complete*. Batteries for gas or diesel powered engines. Truck batteries for half-ton pickups to heavy-duty haulers. Batteries for automobiles, buses, tractors . . . for off-the-highway equipment, aircraft and motor boats.

Nineteen Exide manufacturing and assembly plants cover the country . . . assure prompt service . . . factory-fresh stock. And from every Exide Battery, you can count on dependable starting in all climates, plus an extra long life with low cost maintenance.

**Exide is your best battery
buy . . . at any price**

THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 2
Exide Batteries of Canada, Limited, Toronto
"Exide" Reg. Trade-mark U. S. Pat. Off.



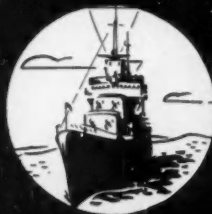
STARTING POWER
for light, medium or
heavy-duty service

1888 . . . DEPENDABLE BATTERIES FOR 63 YEARS . . . 1951

on land, sea and in the air

Acadia Synthetic Rubber Products are once again in great demand for the nation's defense. They are serving in a large variety of important purposes in weapons and equipment on land, sea and in the air. Manufacturers in hundreds of industries have learned they can always depend upon the uniformly high quality of Acadia Synthetic Rubbers.

They are readily compounded to exact degrees of elasticity, resilience, plasticity; offer high resistance to oil, age, light, temperature extremes. They can be molded or extruded—cut to close tolerances in endless shapes and sizes.



sheets • tubing • strips
• channel • washers •
seals • bellows •
gaskets • rings •
extrusions • cut parts



ACADIA

Processors of Synthetic Rubber
and Plastics • Sheets •
Extrusions • Molded Parts

Synthetic

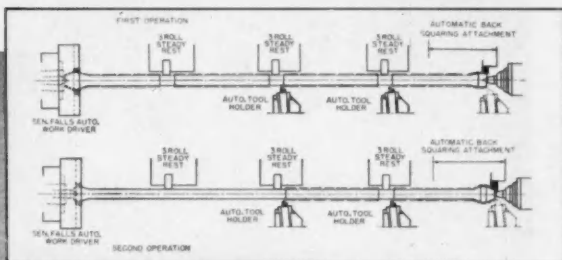
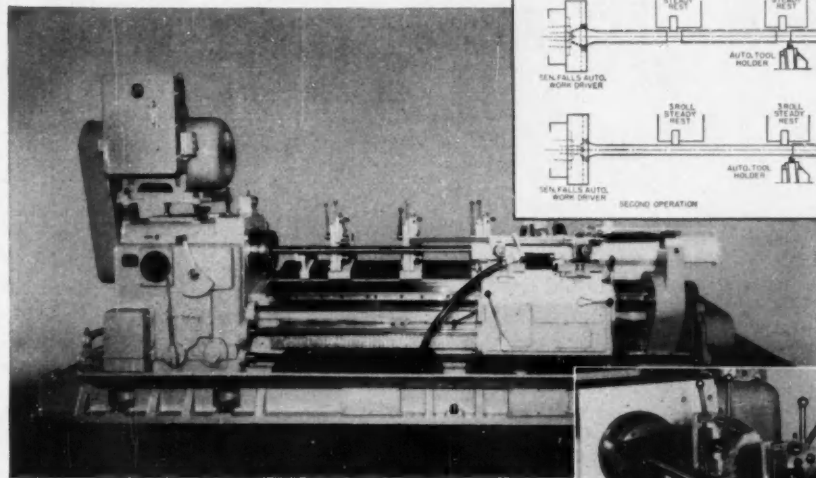
PRODUCTS

D I V I S I O N W E S T E R N F E L T W O R K S

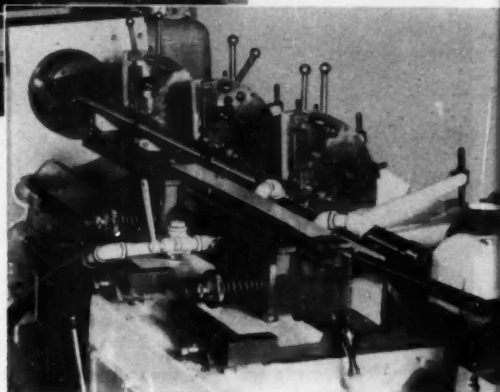
4035-4117 Ogden Avenue, Chicago 23, Illinois

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK



Above: Tooling Layout for 1st and 2nd operations on Torsion Bars.



THE MODEL "AP" Semi-Automatic Lo-swing LATHE ... SOLVES TORSION BAR TURNING PROBLEM

Problem: Turn spline diameters, chamfer or form ends, and turn long undercut on Torsion Bars, 2 3/4" diameter by 80" long.

Solution: The Model "AP" Semi-Automatic Lo-swing Lathe was selected for this work, since its rack and pinion front carriage feed permits long cuts which cannot be made with cam operated, fully-automatic lathes. Also, the design and construction of the Model "AP" bed, carriage and three-roll steady rests permit the front turning tools to pass by the steady rests without interference. This design is very important for turning long Torsion Bars made from high resistance steel and requiring considerable support from steady rests when being machined with tungsten carbide cutting tools.

The operating cycle is extremely simple. The operator loads the Torsion Bars in two cradles clamped to the bed of the machine adjacent to the head and tailstock centers. The control valve for the air-operated tailstock quill is then opened and the Torsion Bar is pushed for-

ward through the Automatic Work Driver and on to the headstock center. The three steady rests are then locked on previously ground spottings; the carriage is power rapid traversed to the cutting position and the cross slides, with their cutting tools, power traversed to the proper depth of cut. At the end of the longitudinal feed, cutting tools are power relieved and the carriage returned to starting position in power rapid traverse.

The contour of the Torsion Bar is controlled by a special template and template operated tool blocks which are visible in the close-up view illustration. This illustration also shows the non-slip Seneca Falls Automatic Work Driver which drives the work.

Two lathes, one for turning each end of the shaft, are usually serviced by one operator.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

PRODUCTION COSTS ARE LOWER WITH Lo-swing

Two Machines Process Transmission Extensions*

OPERATION 1

- ★ Operation 1: bore both ends; face large end; ream flange holes in large end; oil groove small end; chamfer and tap two holes in mounting flange.
- ★ Operation 2: mill mounting flange; drill, bore, chamfer and tap speedometer hole complete; drill, chamfer and tap two inspection cover holes.
- ★ 125 pieces per hour at 100%.
- ★ Features: J.I.C. standard construction; power operated indexing trunnions; fluid motor drive for indexing; single point tool for cross-facing flange of large end.

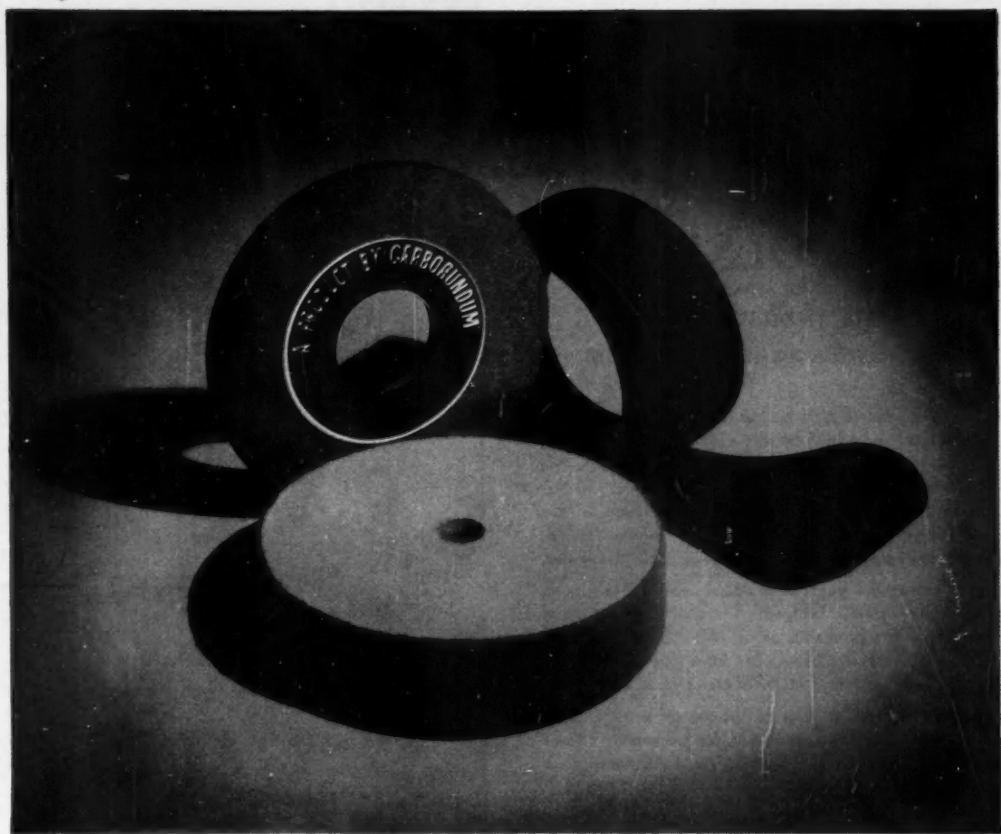
Except for finish bore

OPERATION 2



Established 1898

THE **CROSS** CO.
DETROIT 7, MICHIGAN
Special MACHINE TOOLS



You can't miss...

Not when you pick a product by CARBORUNDUM. A complete line of all abrasive products is your assurance of selective product application. You match the best method with the right product from the complete standard line by CARBORUNDUM.

Thus, the recommendation of an experienced CARBORUNDUM salesman or distributor is not merely helpful...it's impartial.

These men have no reason to offer anything but the best method and product for your job...they sell the only complete line of products identified by the best known name in abrasives.

This experience in all abrasive products and methods is an excellent proving ground for new products and methods. Ask your CARBORUNDUM representative about them. You can't miss.

Only **CARBORUNDUM**

TRADE MARK

makes ALL Abrasive Products...to give you the proper ONE

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company, Niagara Falls, N.Y.

AUTOMOTIVE INDUSTRIES, July 1, 1951

80-28

13

The Sign OF SMOOTH, SURE STOPS!

THE INDUSTRY'S
FINEST POWER BRAKING SYSTEMS

More than two and a half million installations have made Hydrovac the undisputed leader in the field of power braking. And now Bendix Products offers Air-Pak, an air-hydraulic unit similar in design and principle to the Hydrovac. Air-Pak changes air pressure into hydraulic pressure by means of two direct connected pistons, thus combining all the well proven advantages of hydraulic brake action with an air brake system.

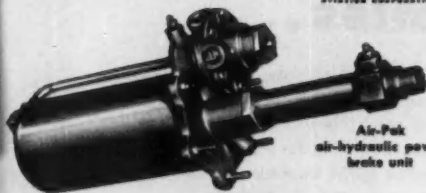
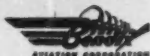
Products of twenty-five years of practical braking experience, these outstanding power braking systems offer faster, more positive and better controlled braking. And in both the vacuum and the air actuated units, brakes can be applied instantly by foot power alone—a safety factor of tremendous importance.

Remember, regardless of size of vehicle or whether your preference is for vacuum or air brakes, for the industry's finest power braking systems be sure to specify Bendix® Hydrovac® or Bendix Air-Pak.

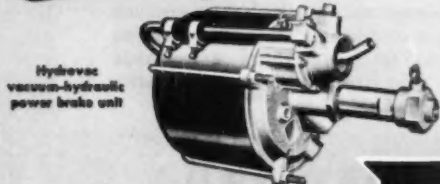
©BIL. U. S. PAT. OFF.

BENDIX • PRODUCTS DIVISION • SOUTH BEND

Export Sales: Bendix International Division, 73 Fifth Ave., New York 11, N.Y. • Canadian Sales: Bendix-Schnee of Canada, Ltd., Windsor, Ontario, Canada



Air-Pak
air-hydraulic power
brake unit



Hydrovac
vacuum-hydraulic
power brake unit

BRAKING HEADQUARTERS for

the AUTOMOTIVE INDUSTRY

*Bendix
Products
Division*



AUTOMOTIVE INDUSTRIES

EDITORIAL STAFF

James R. Custer, Editor
Joseph Geschelin, Detroit Editor
H. H. Roberts, Engineering Editor
Marcus Ainsworth, Statistician
Wm. T. Bostelman, News Editor
Jerome H. Farris, Ass't Editor
Robert P. Homer, Ass't Editor
Thomas MacNew, Ass't Editor
Leonard Westrate, News Editor, Detroit
R. Raymond Kay, Pacific Coast Ed.
Howard Kohlbrener, Art Director
W. F. Bradley, European Correspondent

WASHINGTON BUREAU

George H. Baker, Washington Editor
Karl Rennells, Washington News Ed.

Paul Wooton, Washington Member,
Editorial Board

BUSINESS DEPARTMENT

G. C. Busby, President and Manager
Automotive Division
E. H. Miller, Advertising Mgr.
E. W. Havner, Circulation Mgr.
John Pfeffer, Promotion Mgr.
Charles W. Havner, Research Mgr.

REGIONAL MANAGERS

CHICAGO—John T. Hoole
916 London Guarantee
and Accident Building
Chicago 1, Ill.

DETROIT—E. E. Elder
1015 Stephenson Bldg.
Detroit 2, Mich.

PHILADELPHIA and NEW YORK—
Nelson W. Sieber
Chestnut and 56th Sts.
Philadelphia 39, Pa.
and
100 East 42nd St.
New York 17, N. Y.

CLEVELAND—Jack C. Hildreth
1030 National City Bank Bldg.
Cleveland 14, Ohio

SAN FRANCISCO—R. J. Birch
300 Montgomery St.
San Francisco 4, Calif.

LOS ANGELES—L. H. Jackson
3155 Wilshire Blvd.
Los Angeles 5, Calif.

Editorial and Business Executive Offices
Chestnut and 56th Sts., Philadelphia 39, Pa.
Cable Address Autoland, Philadelphia

High Spots of This Issue

★ Upholstery Requires 700 Operations

For an interesting word-and-picture trip through the Cut and Sew Dept. of the Fisher Body-Pontiac Division, this article is highly recommended. It covers one of the most modern facilities of its kind in the industry. Page 32.

★ Military Vehicle Developments

At the SAE Summer meeting held in French Lick this past June designs of Army wheeled transports were disclosed, described, displayed and discussed. Extracts from some of the meeting's important papers accompany this encompassing article. Page 34.

★ Production-Line Universal Joints

Concerned with the manufacturing activities of Universal Products Co., Inc., Dearborn, Mich., this story shows the wide variety of universal joints possible of production-line handling at the plant of this outstanding producer. Page 42.

★ LPG as a Motor Fuel

Liquefied petroleum gas (LPG) assumes an increasing interest and importance as a motor fuel. Its advantages, characteristics, sales potential, new markets, and distribution are considered in interesting detail, starting page 48.

★ Making Jet Engine Inducers

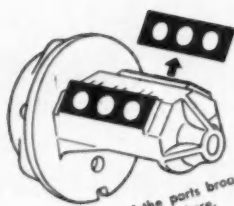
Advanced, complex, and exacting operations are the order of the day at Thompson Products Tapco plant where production of these rotating guide vanes for Allison J33-A-31 and -33 jet engine impellers takes place. See page 54.

★ 24 New Product Items And Other High Spots, Such As:

Latest warplane developments; swing type intake valves; manual handling reduced on Waukesha engine assembly lines; gear makers' annual meeting; checking V-8 crankshafts by air gaging method; Metals; and a new chemical bath that "blasts" scale from forgings.

*News of the Automotive Industries, Page 17
For Complete Table of Contents, See Page 3*

AUTOMOTIVE INDUSTRIES COVERS
PASSENGER CARS • TRUCKS • BUSES • AIRCRAFT • TRACTORS • ENGINES
• BODIES • TRAILERS • ROAD MACHINERY • FARM MACHINERY •
PARTS AND COMPONENTS • ACCESSORIES • PRODUCTION EQUIPMENT
SERVICE EQUIPMENT • MAINTENANCE EQUIPMENT
ENGINEERING • PRODUCTION • MANAGEMENT

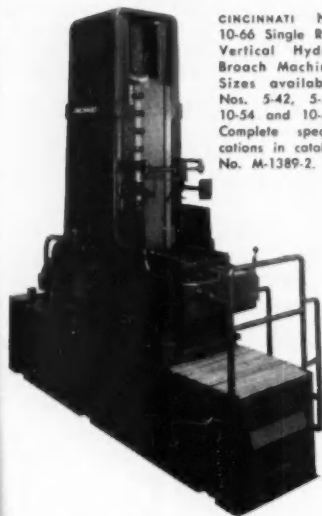


Drawing of one of the parts broached on the equipment illustrated here.

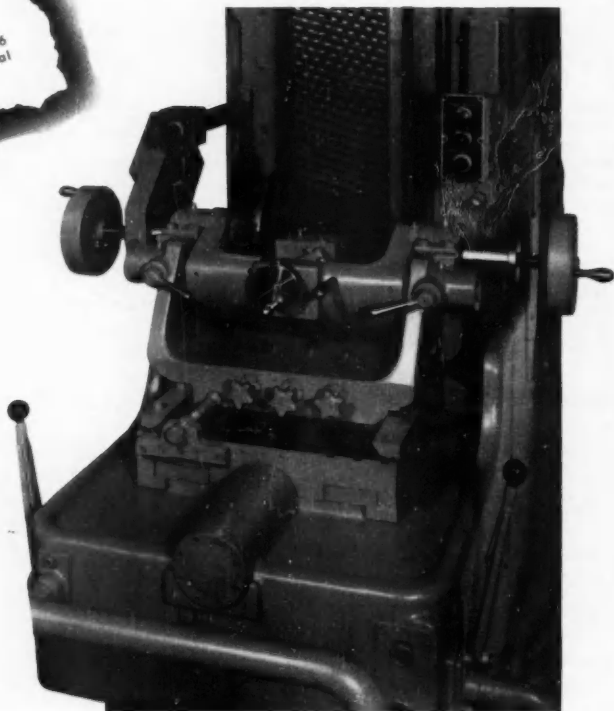
Part name Cylinder for refrigeration unit
Material Cast iron
Operation Broach head surfaces
Stock removal $\frac{3}{32}$ "
Production 15 per hour complete
Machine CINCINNATI No. 10-66 Single Ram Vertical Hydro-Broach

Applying the Advantages of Hydro-Broaching

to a low production job



CINCINNATI No. 10-66 Single Ram Vertical Hydro-Broach Machine. Sizes available: Nos. 5-42, 5-54, 10-54 and 10-66. Complete specifications in catalog No. M-1389-2.



Low rate of production does not necessarily rule out broaching. The equipment illustrated here broaches only 15 parts per hour, but at a lower cost than other methods of machining. ¶ The machine is a CINCINNATI No. 10-66 Single Ram Vertical, equipped with a manually operated index fixture having interchangeable elements for four sizes of parts. For the one illustrated in the drawing, two surfaces of comparatively large area (7" x 3") are broached in two downward strokes of the cutting tools, the work being indexed for the second surface while the table has

retracted during the return stroke of the ram. ¶ Many sizes and shapes of parts, usually groups having family characteristics, are being broached on CINCINNATI's at a big advantage in cost, accuracy and finish. Perhaps you can apply the broaching method of machining to your low production work. To help you analyze the problem, write for our booklet "How to Step Up Production With Cincinnati Hydro-Broach Machines," No. M-1599-1.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES
BROACHING MACHINES • FLAME HARDENING MACHINES
OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

News of the AUTOMOTIVE INDUSTRIES

Vol. 105, No. 1

July 1, 1951

GM Plans Experimental Gas Turbine for Bus

Although still convinced that the gas turbine for commercial truck use will not come for years, if at all, GM will build an experimental 300-hp turbine to be installed in a Greyhound bus. GM does not expect the unit to be practical, but in line with its policy of exploring long range developments

under development since the end of the war.

General Tire Discloses New Synthetic Rubber

The General Tire & Rubber Co., in conjunction with Canada's Polymer Corp., has disclosed the secret of its synthetic rubber development offered to the United States government through

tires wear 18 per cent longer . . . and are produced at a 31 per cent lower rubber cost. Although this achievement is tremendous, we already have proven evidence that we can do much better in the future."

GM May Have New Body in 1952

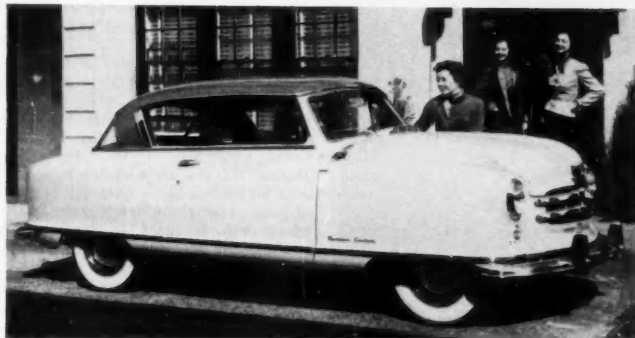
It is reported that there will be one new body in the GM line next year. It is not yet definitely established which division will have it, but it is understood that Oldsmobile is the most likely prospect. If used by Oldsmobile, it will be on the 98 model.

Hazy Output Outlook for Last Half of 1951

As the automobile industry goes into the third quarter, about the only certainty is that fewer cars will be produced during the balance of this year than the more than three million turned out in the first half. There is some difference of opinion about how much production will fall off in the third quarter, but the industry is permitted under NPA quotas to make 1.2 million cars, and it is generally believed that materials will be available for that many. The confused status of CMP complicates industry thinking, but this must be remembered: NPA has so long delayed its decisions on which products are to be covered that lead time schedules for steel mills will not permit CMP to become effective much before the fourth quarter. As a result, there may be more steel for the free market during July and possibly part of August than had been expected.

It is difficult to see where the steel would go if not allocated directly under CMP, unless a rash of special priority orders are given to a large number of products so that they could get on steel mill schedules earlier than under regular CMP procedure. There will undoubtedly be shutdowns and layoffs, but whether or not they will be of the gloomy proportions now talked about, remains to be seen.

Meanwhile, automobile dealers report that sales appear to be improving. This is probably due in part to much more aggressive selling and perhaps to



COUNTRY CLUB NASH

Nash Motors, newly-announced Rambler Country Club, a fully-equipped new 5-passenger hardtop convertible, is the fourth model to be introduced in the Rambler series. The new hardtop is powered by an 82-hp, six-cyl. I-head engine. It has a wheelbase of 100 in.; overall length, 176 in., and width, 73½ in.

in motor transportation will carry on the experiments. High original cost and excessive fuel consumption are the two major problems to be overcome before gas turbines will be commercially feasible, according to C. N. McCuen, head of GM Research. Volume of exhaust, rather than temperature, is also a problem. The turbine under consideration will require three sq ft of exhaust area. Fuel economy is expected to be about four mpg.

Willys Seeking Steel For New Small Car

It is reported that Willys-Overland Motors has applied for a steel allocation to build a small passenger car this fall. There has been no indication whether the appeal will be granted. However, Willys has had a small car

the Reconstruction Finance Corp. last year. This revolutionary process was developed entirely in General's Akron research laboratories with General Tire funds. The new process utilizes extremely tough synthetic rubbers in conjunction with petroleum oils that cost less than two cents a pound. Tire tread rubbers based on two-thirds, or less, tough synthetic rubber and one-third, or more, petroleum oil have been used successfully in the production of tires that have reportedly out-worn tires made from natural or ordinary cold rubber.

"The whole story of what our process means can be summed up quickly," W. O. O'Neil, General Tire president, explained, "one compound, based on the General Tire process, as compared with standard synthetic rubber . . . gives 32 per cent more tires . . . these

News of the AUTOMOTIVE

the effect of repeated pronouncements that production is to be cut in the coming months. In fact some dealers think that there may be a shortage of automobiles again by late summer. At the moment, field inventories are rather substantial for the industry as a whole, and it will probably take a considerable period of reduced production on a scale heavier than anticipated before cars should again become as scarce as they were a couple of years ago.

OPS has indicated that its 3½ per cent increases. Ford and Packard, however, have taken the position that they will grant the wage increase, but at the same time intend to ask for higher prices on their products.

All of the industry has challenged the discriminating effect of the passenger car pricing order on the basis that other industries are permitted to take into account increases in costs since the beginning of the Korean War.

rockets under its defense program. Tooling of the plant is nearing completion, and peak production on present schedules will be attained some time in August. Oldsmobile is turning out the high explosive anti-tank head, practice head, trap and spacer assembly, and the motor metal parts assembly. The rockets are shipped to a government loading plant where propellant and explosive are added, and the fuse and rocket parts assembled. Ten subcontractors supply 15 of the production parts. The rocket production operation utilizes more than 100,000 sq ft of floor space in the plant, which was formerly used for building six-cyl engines.



DEARBORN DRILL

This new improved Dearborn-Peoria fertilizer grain drill is designed to drill grain and distribute fertilizer fast and accurately. The extra large hopper is mounted on a sturdy angle steel box type frame. The implement is made by Wood Bros., a subsidiary of Dearborn Motors Corp., marketing organization for the Ford tractor and Dearborn farm equipment.

Packard Gets Write-Off On New Defense Plant

Packard has been awarded a certificate by DPA, authorizing it to write off 75 per cent of its \$15 million turbojet engine project at an accelerated rate. Packard will build the new plant near its proving ground at Utica, Mich.

Automobile Makers Press For Price Relief

Passenger car manufacturers are increasing pressure against OPS for upward revision of passenger car prices. GM is the only company to agree not to ask for a price increase on the basis of the recent four cent annual improvement factor granted to labor. GM has not said, of course, that it will not seek higher prices based on other cost

upward adjustment allowed March 1 is not necessarily the final determination, a hint that price adjustments may be permitted at a later date. Meanwhile, Dodge has raised truck prices 1½ to 6 per cent under CPR-30, which allows cost increases to be figured in ceiling price calculations.

GM Holders Reject Ceiling on Bonus

GM stockholders have rejected a proposal that would put a ceiling on annual bonus payments to employees. Three stockholders had proposed that a ceiling of \$200,000 annually be placed on all bonus payments.

Oldsmobile Starts Output Of Rocket Order

GM's Oldsmobile Div. is rapidly getting into quantity production of 3.5-in.

New Trailmobile Contract Totals \$4.5 Million

A contract for over 2000 military ordnance vans and platform trailers has been awarded to the Trailmobile Co., Cincinnati, at a cost of over \$4.5 million. Tests of a pilot model of a special 10-ton tandem military Trailmobile has just been completed to the satisfaction of U. S. Army Engineer Corps inspectors. Production will be started at once on a contract totaling over \$2 million for a quantity of units of this special military-type trailer which will be used in transporting crane-shovel attachments used in military engineering projects.

Army Starts Production of New Model Tank

Army Ordnance has quietly gone into production of a new tank at its Detroit Arsenal. The new unit is called the M-47 and supplants the M-46-1A, popularly known as the Patton tank. Details are still classified, but it is known that the new tank weighs 45 tons compared to 47½ tons for the previous model.

Buick to Build New Jet Parts Plant

GM's Buick Motor Div. has announced plans for construction of a large manufacturing plant near Flint, the third to be built for the jet engine program. A two-story building will be built on a 247-acre site, will have 1.6 million sq ft of floor space, and will cover more than 27 acres. It will be used for machining, heat-treating, plating, and sub assembly of parts for the J-65 Sapphire jet engine. Parts will be shipped to Chicago for assembly at a new plant to be constructed there. Buick is also putting up a new 580,000 sq ft plant adjacent to its Flint operation for jet engine parts work.

INDUSTRIES

Ceramic Coatings Tested For Engine Exhausts

The National Bureau of Standards has reported that ceramic coatings for engine exhaust systems will prevent corrosion of metals and alloys. After completing experiments the Bureau reports that three commercially available ceramic coatings proved effective in combatting corrosion. They are known as NBS types A-417, A-19, and A-520.

Hayes Aircraft Awarded Plane Overhaul Order

The Hayes Aircraft Corp., a new subsidiary of Hayes Mfg. Corp., has been granted a contract to overhaul a large number of B-25 bombers which have been in storage since the end of World War II. Tooling of a large plant at Birmingham, Ala., used by the Air Force during the last war will get underway at once. The contract calls for modifying the bombers into training and administrative planes.

Brown-Lipe-Chapin Plans New Jet Parts Plant

GM's Brown-Lipe-Chapin Div. will build a new plant at Syracuse, N. Y., for the manufacture of jet engine parts. The plant will have 400,000 sq ft of area, and will produce parts for the Wright J-65 Sapphire jet engine under a sub-contract from Buick. The division will also produce and assemble compressor stator blade carrier assemblies and turbine stator blades for Buick at the BLC plants in Syracuse and in Elyria, O.

NPA Working on Quotas For Bus Output

The NPA is working on an order similar to M-68 (passenger cars) which would likewise set up production quotas for motor bus output. Defense Transportation Administration officials say that at least 22 per cent of the approximately 86,000 common-carrier buses now on the road need replacement, and that such an order is needed to assure adequate production or expansion.

GM Buys Arizona Site For Proving Ground

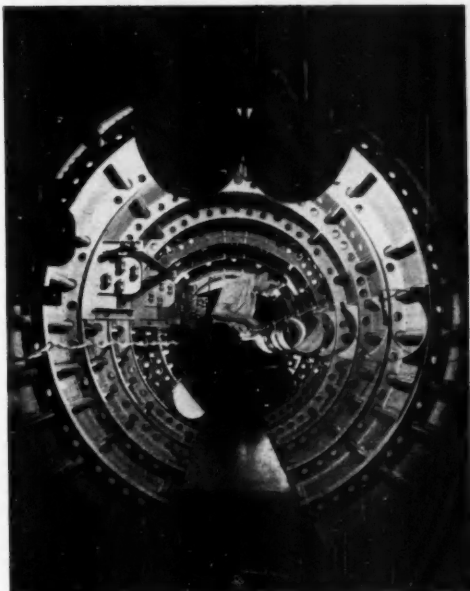
GM has doubled its proving ground facilities through the purchase of a 2280-acre site near Phoenix, Ariz., for a hot weather test area. The Arizona proving ground will be used for test-

ing cars, trucks, and buses, and development testing of military vehicles, including tanks. Initial construction will include a five mile circular banked tract, and a two mile level straight-away. It will be used for controlled tests such as heat rejection, oil and fuel economy, performance, durability, and brake deceleration. Additional roads may be added whenever required.

peller-driven ships of 190-cu in. displacement.

British Daimler Has New Coach Chassis

The latest recruit to under-floor mounting of the power plant is English Daimler (Transport Vehicles, Daimler, Ltd.) with a 196 in. or 210 in. wheel-



LOOK IN

Looking into one of the Fairchild Aircraft Div. C-119 Flying Boxcar's two giant tail booms, being readied as a unit for incorporation into the fuselage structure of the troop and cargo-carrying C-119. The boom is having the hot air ducts installed which form part of the plane's anti-icing system. At top of picture are oxygen supply bottles.

GM has tested vehicles in Arizona since 1937 when it established its Phoenix laboratory as a branch operation. The new proving ground makes possible prolonged tests of high speed operations under controlled conditions without interference from other traffic.

1951 Air Races to be Held In Detroit, Aug. 18-19

The 1951 National Air Races will be held at the Detroit Wayne-Major Airport on Aug. 18-19, as part of Detroit's 250th Birthday Celebration. Over a million square feet of exhibits of the latest developments in engines and planes will be displayed. The highlights of the two-day Air Show will be the six jet events. These races will be flown for the Thompson, Bendix, Allison, and very likely the General Electric and Westinghouse trophies. Of equal interest will be the \$25,000 Continental Motors Trophy Race for pro-

base coach chassis known as the Free-line. This title indicates that no part of the mechanism, with the exception of the steering gear and brake lever, projects above the top of the straight side rails. This, together with outrigger brackets, gives a flat, unbroken surface on which the body can be mounted with the maximum convenience. The front axle is set back sufficiently to allow a front entrance by the side of the driver.

Mechanically, the design follows that of the Daimler coach chassis with vertical engine. Use is made of the Daimler six-cyl 5 in. by 5 1/2 in. Diesel engine, developing 125 hp at 1800 rpm. An alternative power plant is the Gardner 6HLW flat six, which can be fitted with the Gardner type of engine mounting. Changes made in the Daimler because of the new position are to be found in the crankcase and in the position of the water pump.

The radiator, set just behind the

News of the AUTOMOTIVE

1951 NEW PASSENGER CAR REGISTRATIONS*

Arranged by Makes in Descending Order According to the 1951 Four Months' Total

MAKE	FOUR MONTHS							
	April 1951		March 1951		April 1950		Units	
	1951	1951	1951	1951	1950	1950	1951	Per Cent of Total
Chevrolet	99,191	110,166	121,188	412,660	427,109	21.92	24.31	
Ford	85,184	88,497	103,499	324,299	363,111	17.22	20.66	
Plymouth	51,577	52,175	4,919	189,094	90,253	10.04	5.13	
Buick	35,979	42,969	47,467	153,581	157,394	6.15	8.95	
Pontiac	29,543	33,480	36,916	120,523	133,563	6.62	7.90	
Oldsmobile	29,101	29,686	32,116	103,661	113,100	5.50	6.43	
Dodge	25,389	29,379	4,337	103,572	86,416	6.50	3.21	
Mercury	19,722	21,821	28,646	84,897	86,511	4.51	5.43	
Studebaker	18,657	18,561	28,287	71,979	94,479	3.82	5.38	
Chrysler	15,988	18,967	2,296	58,951	28,375	2.87	1.61	
Nash	11,123	11,619	18,086	43,943	49,431	2.33	2.81	
Hudson	9,179	12,124	13,754	40,682	44,484	2.16	2.53	
De Soto	8,594	10,212	1,676	37,917	20,318	2.01	1.16	
Cadillac	8,353	8,966	7,724	35,163	21,936	1.87	1.25	
Packard	5,721	7,068	7,726	25,943	23,198	1.38	1.32	
Kaiser	5,116	6,473	2,914	22,461	11,398	1.19	.85	
Henry J.	5,451	6,582		21,319		1.13		
Lincoln	2,147	2,226	3,001	9,902	10,142	.91	.89	
Willys	2,182	2,494	2,279	9,289	9,314	.49	.47	
Crosley	494	697	495	2,121	2,199	.11	.12	
Frazer			1,850		3,131		.18	
British Austin	252	292	489	1,266	2,010	.07	.11	
British Ford	190	190	101	932	240	.05	.02	
Misc. Domestic	245	79	16	532	91	.03	.01	
Misc. Foreign	939	1,079	474	4,108	1,447	.22	.08	
Total—All Makes	467,313	512,999	471,215	1,853,476	1,757,652	100.00	100.00	

* Based on data from R. L. Polk & Co.

front axle, has its top just below the level of the side rails, and is equipped with a shrouded fan running at 1½ times engine speed, the inner periphery of the cowl being machined to give a fine clearance to the five fan blades. In addition to this cooling, there is a contra-flow type of heat exchanging element made up of 58 tubes arranged horizontally in four rows between water tanks at the sides. In accordance with Daimler policy, use is made of a hydraulic coupling of 18 in. diameter and a separate five-speed, pre-selective transmission with direct drive on fifth. An open shaft transmits power to the underdriven worm gearing. The final reduction ratio is 4.66 to 1. Some changes have been made in the steering layout, the drag link being taken from the drop arm to a bell crank mounted centrally on one of the frame cross members and from there by a tubular rod to an arm on one steering knuckle.

Springs are long semi-elliptics all round, supplemented by hydraulic shock absorbers. A cross bar is incorporated in the rear hanger brackets of all springs to limit the rear movement of the axle in the case of a main leaf breakage. The brake application is by the Lockheed hydro-pneumatic system. This new chassis is just going into production, the first models off the line being fitted with the Gardner engine.

Chrysler Gives Tips On Sub-Contracting

Chrysler has issued a list of recommendations for small manufacturing

businesses seeking defense work from larger contractors. They include: (1) determining whether the regular commercial product is suitable, with possible adjustments, to the defense effort, or whether an entirely new product is required. (2) analyzing equipment and processes to see whether they are well adapted to a wide field of defense work. (3) decide on an item for the defense effort and seek a major contractor who can use it. Such information is available from Defense Agencies, the Commerce Dept., Chambers of Commerce and trade associations. (4) use the same selling effort as for a civilian product to convince the prime contractor of ability to produce the item on schedule, to the required specifications, in volume required, and at a fair cost. (5) upon receipt of an order, find out what the customer expects in the way of tooling, samples, deliveries, and engineering changes.

K-F Japanese Plant Builds First Car

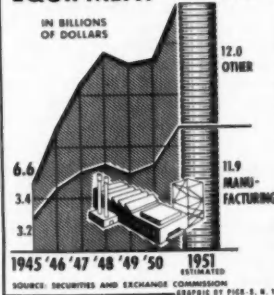
East Japan Kaiser-Frazer, Ltd. has turned out its first Henry J, the first American car produced in that country since the beginning of World War II. Initial production is at the rate of 500 cars a year, but is scheduled to be expanded. The Kaiser-Frazer operation is a subsidiary of East Japan Heavy Industries, Ltd., one of three industrial groups formed when the Mitsubishi industrial empire was broken up.

Components for the cars made in Japan are shipped from Willow Run. Kaiser-Frazer currently has four other foreign branches: at Haifa, Israel; Toronto, Canada; Mexico City, Mexico; and Rotterdam, Holland.

New Techniques Help Cut Munitions Cost

Considerable savings in materials and man hours in production of military equipment have been achieved since the end of World War II through adoption of new processes and techniques and development of tools and machines, according to General M. H. Davis, chief of the Ammunition Branch, Industrial Div. Addressing the Detroit Chapter of ASTE, he said that whereas during World War II it was not possible to make entirely satisfactory steel cartridge cases, the military now has completely abandoned brass for cartridge cases and is making them from steel even in the large sizes. He discussed new methods for making projectiles by the cold extrusion method resulting in reducing material losses to a matter of ounces compared with losses ranging from 6 to 16 pounds with the forging and machining method

EXPENDITURES BY U.S. BUSINESS FOR NEW PLANT & EQUIPMENT



used during the last war. He said that even large shell cases can be produced by this method, and that about six per cent of production now is being made from extrusions.

He also said that the military is making projectiles using a hot forged cup followed by cold drawing. Another development he discussed was a method of sizing seamless tubing, using a broach-like tool which does not remove much material but forms interiors to the desired concentricity, and also can be used for straightening short lengths. General Davis also said that high speed

INDUSTRIES

machining techniques developed since the end of the war have greatly increased production and cost savings in munitions manufacture.

French Talbot Automobile Resumes Production

The French Talbot Automobile company has resumed production after having been closed for one month. Under the terms of the judicial liquidation, an eight-year moratorium has been obtained and an arrangement made to pay creditors in full. The works remain under the direct control of A. Lago who, it is understood, also has the main financial holding. New models have been prepared and will be presented at the Paris show for delivery immediately after that event. There will be one chassis and one main body style only, with an option of three engines.

Cummins Expansion to Cost \$6 Million

Cummins Engine Co., Inc., will spend most of the \$6 million allotted to its expansion program for machinery and equipment. The expansion project will extend over the next two years, and is designed to increase production capacity at least 50 per cent. Since the end of World War II, Cummins has spent more than \$6 million to increase its capacity about 60 per cent.

GM's Delco Appliance to Build New Plant

GM's Delco Appliance Div. is going to build a plant containing 500,000 sq ft in Rochester, N. Y. A single-story structure, this building is being erected for the manufacture of defense products, particularly small motors used by the Air Force.

Willys Gets Government Aluminum Forge Plant

Willys-Overland has taken over active operation of the Aluminum Forgings, Inc. plant at Erie, Pa., a government-owned facility which has been held in reserve since the end of the World War II. Willys will operate the facility for the General Services Administration. The plant is completely equipped for production of aluminum forgings, with a battery of 27 hammers ranging up to 20,000 lb capacity, and other equipment such as furnaces, drill presses, and etching and cleaning equipment. Willys will operate the plant on a three-shift basis employing about 1000 workers.

Amyl Nitrate Studied As Fuel Additive

Both the Navy and Ethyl Corp. have experimental programs under way to test the value of amyl nitrate for improving the cetane number of Diesel fuel. Ethyl has no plans now for commercial sale of the additive, and future plans will have to wait on results of much more complete tests. An important advantage that could be realized from such a successful additive would be standardization of cetane number for fuel across the country. It now varies as much as 15 cetane numbers, and engines must be designed to operate with the lowest cetane number fuel available.

Gabriel Company Merges With Burd Piston Ring

The Gabriel Co. of Cleveland has completed a merger with the Burd Piston Ring Co. Burd will become a division of Gabriel.

Nickel-less Car Trim Needs Special Care

Problems arising out of government orders restricting or prohibiting use of nickel in automobile trim parts are causing headaches for passenger car builders. Nickel is still permitted in bumpers, bumper guards, and door handles, but the thickness has been limited to .001 in. In other parts, nickel is not permitted, with the exception that platers may continue to run out the nickel left in baths at the time of

the effective date of the order. As a result, some parts are already being plated with chrome directly over the copper, whereas items obtained from other suppliers may continue with nickel running through July or August. This complicates instructions to buyers of automobiles on the proper care of plated parts having only the copper-chrome treatment plus a layer of protective enamel or lacquer. Buyers are warned not to use harsh abrasive on lacquered or enamel parts. Several companies are already including instruction on proper care of these parts in owner's manuals.

Trucks Haul 75 Per Cent of Nation's Freight

According to an Automotive Manufacturers Association study, based on statistics from governmental agencies, 75 per cent of the nation's total freight tonnage is hauled by motor truck. In a new booklet called *Motor Trucks and National Defense*, the AMA points out that trucks now carry 8.3 billion tons of freight a year, including three billion tons hauled entirely within city area. It also emphasizes that during World War II, trucks hauled up to 75 per cent of both inbound and outbound freight at war plants. The booklet also states that truck registrations have risen 70 per cent in the last 10 years to a high of 8.6 million units, nearly 30 per cent of which today are 10 or more years old. AMA estimates that about 800,000 new trucks are required annually for replacement purposes.

1951 NEW TRUCK REGISTRATIONS*

Arranged by Makes in Descending Order According to the 1951 Four Months' Total

MAKE	April 1951	March 1951	April 1950	Units		Per Cent of Total	
				1951	1950	1951	1950
Chevrolet	29,678	30,170	34,853	116,013	115,799	34.34	35.30
Ford	21,371	21,356	27,231	82,843	92,722	24.46	28.27
Dodge	8,513	9,038	4,981	36,853	27,620	10.91	8.48
G. M. Oldsmobile	8,791	8,702	7,772	34,381	29,753	10.17	8.15
International	8,070	6,292	8,512	32,174	29,814	9.82	9.09
Studebaker	2,385	2,492	3,872	10,531	15,401	3.12	4.69
Willys Truck	1,322	1,313	923	5,637	3,494	1.67	1.06
White	1,146	1,076	969	4,554	3,173	1.34	.97
Mack	1,009	1,088	804	4,103	3,192	1.21	.87
Willys Jeep	798	621	727	2,803	2,565	.83	.76
Diamond T	422	456	495	1,664	1,768	.49	.54
Oliver	364	356	343	1,444	1,146	.43	.35
Roe	284	366	269	1,410	1,024	.42	.31
Brookway	214	269	185	994	667	.29	.30
Autocar	203	226	205	774	673	.23	.21
Federal	102	94	102	408	375	.12	.11
Pontiac	68	51	172	283	639	.07	.19
Kenworth	42	55	45	247	141	.07	.04
P. W. D.	37	60	30	185	109	.06	.03
Peterbilt	28	49	22	122	122	.04	.04
Sterling	27	33	27	121	103	.04	.03
Misc. Domestic	121	126	143	854	593	.16	.16
Misc. Foreign	29	20	31	79	162	.02	.05
Total—All Makes	84,961	86,267	92,241	337,897	328,130	100.00	100.00

* Based on data from R. L. Polk & Co.

News of the AUTOMOTIVE



CHANGING APPEARANCE

Newly-announced by Lockheed Aircraft Corp. is this Neptune for air rescue service. Equipped for air search and rescue operation over land, sea, or ice and snow, this ARS Neptune assumes a different appearance for different assignments. The patrol plane is shown here carrying a droppable life raft under its fuselage for over-ocean missions. The arctic rescue version is equipped with this fitted over the wheels of its regular landing gear. The plane is adapted from the basic P2V Neptune design in service since 1945 with the U. S. Navy.

Allen Group Buys Avco's ACF-Brill Holdings

A group headed by Charles Allen, Jr., and Allen & Co., New York investment banking firm, has bought the Avco Manufacturing Corp.'s security holdings in the ACF-Brill Motors Corp. Avco held 48.6 per cent of ACF-Brill's common stock in addition to notes and warrants. Allen & Co. controls the ownership through stock holdings of the Cincinnati Newport Covington Railway Co., and the Lehigh Valley Transit Co., and subsidiaries, bus operating companies.

Leece-Neville to Expand

The acquisition of additional manufacturing space for its expanding business has recently been announced by the Leece-Neville Co., makers of automotive electrical equipment in Cleveland, O. Some 16,000 sq ft of new floor space will be devoted to light manufacturing divisions. Currently some 60 per cent of Leece-Neville business consists of DO rated orders. The company's board of directors have accepted the resignation of S. F. Stewart as president.

Bendix Aviation Forms Two New Divisions

The Bendix Aviation Corp. has purchased two additional plants and will form two new manufacturing divisions.

It has acquired the Utica, N. Y. plant of Continental Can Co. for production of military products, and has purchased the South Montrose Mfg. Co. of South Montrose, Pa., also for production of defense items. The two new divisions established will be known as the Montrose Div. and the Utica Div. The ac-

quisitions are the third and fourth expansion since the outbreak of the Korean War.

Truckstell Has New Overdrive For Chevrolet Trucks

The Truckstell Manufacturing Co., Cleveland, O., has introduced a new auxiliary overdrive transmission for Chevrolet light trucks. Shifting of the new overdrive auxiliary transmission is manual, and the driver has a selection of six forward speeds. A control knob, located at the left of the steering wheel, is pulled out for overdrive, pushed in for conventional drive. The driver can shift at any speed by first depressing the clutch.

Continental Earnings Show Sharp Increase

Continental Motors reports a sharp increase in earnings for the first half of this year as compared with the same period a year ago. After provision for taxes and for stockholders of a subsidiary, earnings totalled \$2,111,191 for the six months ended April 30, compared with \$1,374,351 for the same period a year ago. Provision for taxes this year total more than \$2.4 million compared with slightly more than \$1 million last year.



CARS AND PLANES

As shown in the photograph above, airplane and automobile production will be contiguous in Kaiser-Fraser Corp.'s Willow Run plant. In the foreground aircraft machinery is moved into place, while only a few feet away car production operations continue on newly-installed paint lines.

INDUSTRIES

Chrysler Well Along With Indiana Plant

Construction work on Chrysler's new parts manufacturing plant at Indianapolis is making good progress and should be completed by late summer. When completed the manufacturing building will have a work area of 650,000 sq ft.

Willys Protects Jeep Parts with Wax Dip

Willys-Overland is spending \$750,000 for equipment for protective packaging of spare parts for Jeeps before shipment to Army bases overseas. The process involves cleaning and dipping the parts in light oil, wrapping them in cloth or paper, and dipping in wax.

foreman of the Ordnance Div., in 1918, master mechanic, assistant production manager, production manager, works manager, vice president in charge of manufacturing, and since 1943, vice president and general manager. During his career, he contributed to several important automotive and related developments, including a military command car, manufacturing of recoil mechanisms by mass production methods, and military vehicles and Sperry gyrocompasses during World War II.

Mason Reelected Head of AMA

G. W. Mason, president of the Nash-Kelvinator Corp., has been reelected president of the Automobile Manufac-

Wirshing said, evidence indicates that it is a reducing action and not oxidation that causes finishes to deteriorate. The results of the tests do not mean that problems with paint chalking are solved, he added, but merely that a new avenue of approach is opened. Certain tests have been made with oxidation additives in paints, but there still is much to be done.

McCloud of Ford Elected Engineering Group Head

J. L. McCloud, manager of manufacturing research for Ford, has been elected president of the Engineering Society of Detroit. He has been a director since 1949, and has held several offices in the Society.

REGIONAL SALES OF NEW PASSENGER CARS

Zone	Region	April		March		April		Four Months		Per Cent Change		
		1951	1950	1951	1950	1951	1950	1951	1950	April over March	April over April 1950	Four Months over Four Months 1950
1	New England	29,584	30,373	28,151	109,571	96,238	2,700	+4.98	+13.86			
2	Middle Atlantic	89,888	100,767	90,077	344,582	329,161	15,421	+4.68	+4.68			
3	South Atlantic	93,781	97,372	94,628	228,571	206,578	21,993	+10.65	+10.65			
4	East North Central	128,757	140,349	118,635	495,691	432,798	62,893	+14.53	+14.53			
5	East South Central	19,538	26,719	22,254	89,143	84,105	5,038	+5.99	+5.99			
6	West North Central	51,196	49,190	53,211	193,318	178,878	14,440	+8.07	+8.07			
7	West South Central	37,577	38,026	38,619	169,132	169,086	46	+0.03	+0.03			
8	Mountain	14,949	17,632	17,030	63,826	57,370	6,456	+11.26	+11.26			
9	Pacific	42,123	52,069	47,613	192,639	191,462	1,177	+0.61	+0.61			
Total—United States		467,313	512,999	471,215	1,863,475	1,737,652	125,823	+7.16	+7.16			

States comprising the various regions are: Zone 1: Conn., Me., Mass., N. H., R. I., Vt.—Zone 2: N. J., N. Y., Pa.—Zone 3: Del., D. C., Fla., Ga., Md., N. C., S. C., Va., W. Va.—Zone 4: Ill., Ind., Mich., Ohio, Wisc.—Zone 5: Ala., Ky., Miss., Tenn.—Zone 6: Iowa, Kan., Minn., Mo., N. D., S. D.—Zone 7: Ark., La., Okla., Tex.—Zone 8: Ariz., Colo., Ida., Mont., Nev., N. M., Utah, Wyo.—Zone 9: Cal., Ore., Wash.

Materials Lack Forces GM Six-Day Shutdown

In order to avoid large scale layoffs resulting from anticipated shortages of materials, GM will shut down for six working days from July 28 through August 6, in Chevrolet, Pontiac, Oldsmobile, Buick, and Cadillac plants, in the Michigan area. Similar shutdowns will be scheduled for some GM accessory parts and division, as well as passenger car assembly plants, in other states.

Dodge Honors Lamborn's 40-years of Service

To commemorate 40 years of service with Dodge, Fred J. Lamborn, vice president and general manager, was honored recently at a luncheon given by his associates, including K. T. Keller and L. L. Colbert, board chairman and president of Chrysler Corp. Mr. Lamborn joined Dodge as a tool maker in 1911 while on a stop-over in Detroit on his way to the East. Since that time he has risen through the organization, holding such posts as general

turers Association. All other officers and directors whose terms expired were also reelected. H. H. Curtice, executive vice president of GM and secretary of AMA, was elected to fill out the unexpired term of M. E. Coyle, former director.

GMR Upsets Theory On Paint Film

As a result of extensive research during the past few years, GM Research Laboratories has apparently upset previous theories that dulling and chalking of automotive finishes is a result of oxidation. In a paper before ASTM, June 20, Ralph J. Wirshing, head of the GMR chemistry department, cited tests with hydrogen peroxide, commonly considered to be an oxidizing agent, in an attempt to stimulate chalking, with negative results. However, it was discovered that under certain conditions hydrogen peroxide acts as a reducing agent, and when these conditions were met, panels with lacquered and enameled surfaces dulled and chalked rapidly. Consequently, Mr.

World Metals Congress To Meet in Detroit

More than 500 representatives from 20 countries will attend the World Metallurgical Congress in Detroit, Oct. 14-19, the first international meeting of its kind. Delegates will represent upwards of 20 countries, under sponsorship of ECA. Director General of the Congress will be Dr. Zay Jeffries, retired vice president of General Electric and a past president of the American Society for Metals.

'51 Beecroft Award to King

Rudolph F. King, registrar of motor vehicles of the Commonwealth of Massachusetts, received the 1951 David Beecroft Memorial Award on Traffic Safety. The presentation was made by Dale Roeder, president of the Society of Automotive Engineers. Mr. Roeder is executive engineer of commercial vehicles, Ford Motor Co. Mr. King won the award for his able administration of traffic safety in Massachusetts and his long interest in safety education.

News of the AUTOMOTIVE INDUSTRIES

Allis-Chalmers to Spend Half-Million for Tools

Allis-Chalmers Manufacturing Co. will spend more than half a million dollars for replacement of machine tools, as part of its \$1 million expansion and improvement program for its plant at Norwood, O. The program includes construction of a new foundry and a warehouse to be completed within a year.

Three Companies to Develop Xeroradiography

The commercial development of xeroradiography is the object of a joint program launched by three organizations: the Haloid Co., Rochester, N. Y.; Battelle Memorial Institute, Columbus, O.; and the General Electric X-Ray Corp., Milwaukee, Wis. Expected to make x-ray inspection faster and more economical, xeroradiography is a fast, low-cost, dry, direct-positive process for producing x-ray images. It is electrostatic, rather than chemical in nature.

Ryan Building New Plant in San Diego

The Ryan Aeronautical Co. is building a new factory building at its San

Diego, Calif., site for the production of jet engine components, according to T. Claude Ryan, president. The new \$300,000 structure will add 75,000 sq ft to the company's facilities.

Douglas Aircraft Buys Land and Buildings

Douglas Aircraft Co. purchased four acres of land and 57,000 sq ft of buildings at Bell, Calif., for use as an aircraft sub-assembly and honeycomb manufacturing plant. About \$200,000 worth of equipment, including one of the largest heated bonding presses in the country, was also purchased.

Norton Plans \$6 Million Expansion

The Norton Co. has announced an expansion plan costing \$6 million. A new 6½-acre plant for the manufacture of Norton grinding machines will be built in Worcester, Mass. The new plant will consist of a 740-ft by 300-ft factory joining a 360-ft by 100-ft office building.

LeTourneau Building Steel Mill in Texas

R. G. LeTourneau, Inc., has started construction of its own steel mill at its

plant at Longview, Tex. The mill is expected to be in operation by the end of this year, and will be capable of turning out 1000 tons a day of finished steel plate 144 in. wide, ranging in thickness from 3/16 of an in. to 12 in. A building 100 ft wide by 500 ft long is being built to house the mill.

Name Bedford Assistant to ODM Head

Clay P. Bedford, executive vice-president of Kaiser-Frazer Corp., has been named assistant to Mobilization Director Charles E. Wilson. ODM officials said that Mr. Bedford's new assignment would be concerned with ways of stimulating defense production.

Award Gary Memorial Medal to Edward L. Ryerson

Edward L. Ryerson, chairman, Inland Steel Co., Chicago, was presented the Gary Memorial Medal for outstanding achievement in the iron and steel industry at the 59th general meeting of American Iron and Steel Institute in New York recently. The presentation was made by Eugene G. Grace, chairman, Bethlehem Steel Co.

Willys Forms Division For Electronics Unit

Willys-Overland has formed an electronics division and has acquired a modern plant at Toledo to house the operation. It will add about 100 electronics and mechanical engineers to its present basic staff of specialists. The company has received two development contracts in the electro-mechanical field, from Glenn L. Martin Aircraft Co., and the U. S. Signal Corps. Details and dollar values of the contracts were not disclosed.

Mann Elected Chairman of GM Regents

George Mann, Jr., general manager of GM's AC Spark Plug Div., has been elected new chairman of the Board of Regents of GM Institute. He succeeds Cyrus R. Osborn, vice president and group executive of GM, and will also assume duties of chairman of the executive committee of the board. New vice chairman is Edward B. Newill, GM vice president and general manager of Allison Div. The board consists of 34 members, all of whom are GM executives.



BANK BODY

A standard Boyertown body on a Ford F-3 chassis is being used by the Girard Trust Corn Exchange Bank, Philadelphia, in an unusual way. The body was the answer to the plea of bank messengers and guards for more headroom. Now with the new Ford truck, the guards can walk in and out of the truck comfortably, and the truck has a low rear step and double rear doors. The truck is used to haul money and payrolls, and to take mail to the post office.

Men in the News

Current Personnel Appointments and Changes at Plants of Automotive Manufacturers and Their Suppliers

United Aircraft Corp., Hamilton Standard Div.—**T. A. Sims** has been appointed assistant general manager.

The Bell Aircraft Corp.—**Roy H. Coleman** has been named manager of manufacturing for the recently-created Helicopter Div.

Ford Motor Co.—**Robert C. Armour** has succeeded **A. L. Edwards** as manager, Long Beach, Calif., assembly plant.

Hiller Helicopters, Inc.—**Frank Watson** has been named vice-president and contract administrator, and **William Renison** has been named factory manager.

Kaiser-Frazer Corp.—**A. J. Bedworth** has been named chief assistant to **O. E. Johnson**, K-F general planning superintendent, aircraft division.

B. F. Goodrich Co.—**William L. Carpenter**, production superintendent of the company's tire plant in Miami, Okla., has been made manager of the tire plant in Oaks, Pa.

Tung-Sol Lamp Works, Inc.—**Milton R. Schulte** has been named vice president in charge of manufacturing electron tubes, cathode ray tubes and flashers. **Dr. Alfred K. Wright** has been named vice president and director of engineering, and **Jean E. Witbeck** vice president in charge of lamp manufacturing.

Allied Products Corp.—At a recent board meeting, **Frank H. Bishop** was elected executive vice president.

Kearney & Trecker Corp.—**Ralph W. Burk**, vice president of sales, was elected vice president for manufacturing. **Mr. Burk** will also continue as head of the company's sales division.

Dearborn Motors Corp.—Appointment of **Wayne B. Garber** as national service manager has been announced.

Koppers Co., Inc., Metal Products Div.—**Nicholas Kay**, manager of the Piston Ring plant at Baltimore, was named assistant manager of the Div.'s Production Dept., and **Thurman F. Naylor** has been appointed manager of the Div.'s Contracting Dept.

Trailmobile Co.—Appointment of **L. F. Manneschildt** as manager of the used trailer department has been announced.

Ross Operating Valve Co.—**Russell J. Cameron**, former vice president in charge of sales, has been elected president, succeeding **John Sainsbury**, who will remain as an active consultant and member of the board of directors.

Simmonds Aeroaccessories, Inc.—**Matthias Plum** was elected to the board of directors.

Continental Motors Corp.—**Edward J. Brichta** was appointed sales manager of the industrial air-cooled engine division.

The Lincoln Electric Co.—The appointment of **J. S. Roscoe** as director of purchasing has been announced.

General Electric Co.—The appointment of four new managers to positions in the turbojet engine plant, Lockland, O., have been announced: **George L. Zimmerman**, manager of assembly division; **Paul Nichols**, manager of development manufacturing division; **A. W. Jacobsen**, manager of the parts division; and **Marc A. DeFerranti**, manager of facilities for the Lockland plant.

General Electric Co., Fractional Horsepower Motors Divisions—**B. R. McClure** has been appointed assistant to the manager of sales. **Enno W. Lankenau** has retired as manager of the Decatur, Ind., plant. He will be succeeded by **John F. Welch**. **D. C. Hanson** has been made manager of the Refrigeration Equipment Sales Div. and **K. R. Whearley** has been placed in charge of the Distribution, Parts, and Service Sales Section.

General Electric Co., Control Divisions—**Dr. Louis T. Rader** has been appointed assistant manager of engineering.

Kollsman Instrument Corp.—**Jay E. Browder** has been appointed chief of the Radio Communications Engineering Section.

B. F. Goodrich Chemical Co.—**Glen E. Wilson** has been named director of employee relations, a newly-created post.

The Four Wheel Drive Auto Co.—**Charles Glocke**, field service manager, has been named manager of the FWD service division.

Westinghouse Electric Corp.—The appointment of **Thomas R. Lawson** as assistant sales manager of industrial products has been announced.

Thermoid Co.—**Laurence C. Ward, Jr.** has been elected vice president in charge of special sales.



B. F. Goodrich Co.—**James F. Sweatt** has been named manager of the company's Los Angeles, Calif., tire plant.

Automatic Steel Products, Inc.—At a recent meeting of the board of directors, **Douglas H. Miller** was elected treasurer.



E. I. duPont de Nemours & Co. (Inc.)—**Richard D. Scheer**, assistant sales promotion and advertising manager of the Polychemicals Dept., has been made assistant sales manager, "Zerone" and "Zerex" anti-freeze sales.

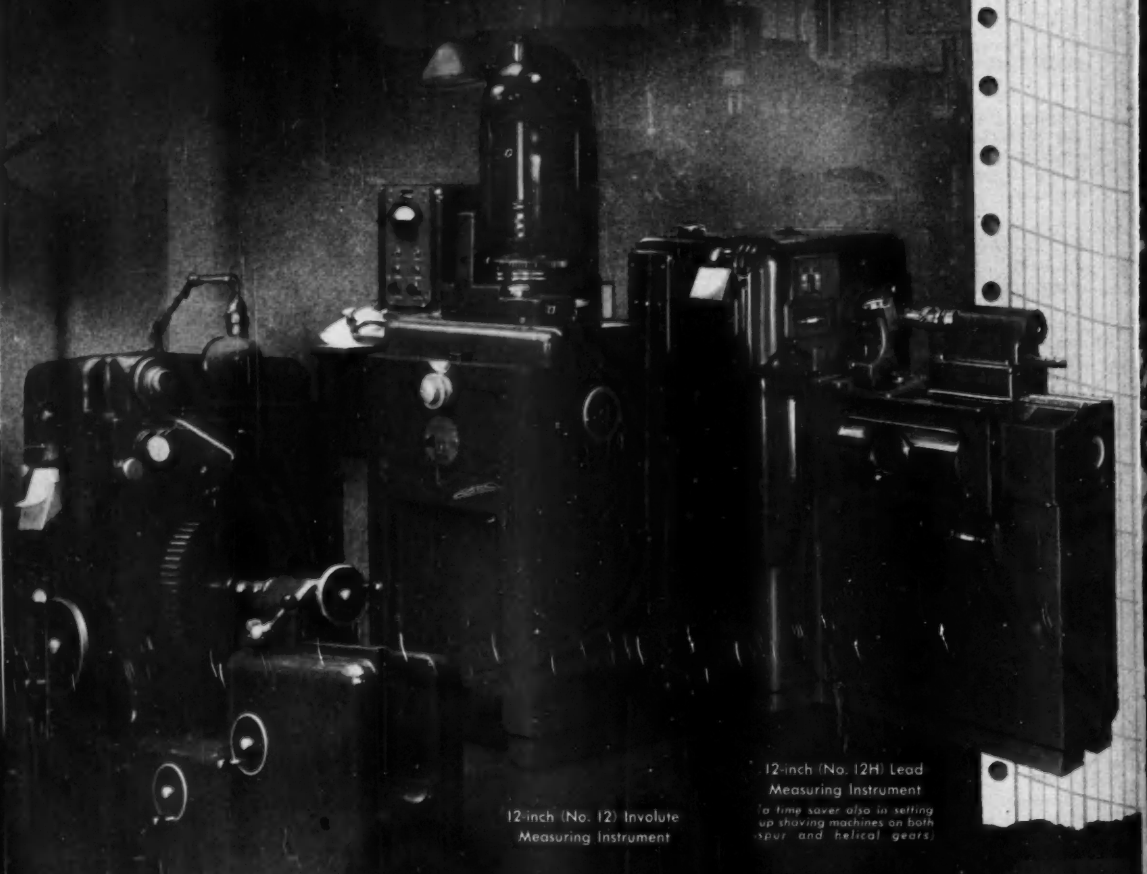
General Motors Corp., Buick Motor Div.—**Joseph J. Schweinfurt** has been appointed assistant general superintendent in charge of jet engine production.

Ford Motor Co., Lincoln-Mercury Div.—**Lewis K. Marshall** has been made manager of the gas turbine plant; **Owen L. Marsal** has been named manufacturing manager; **R. E. Bussey** will be chief product engineer and will head the product engineering department; and **H. F. Roberts** has been designated purchasing agent and will be responsible for all procurement under present and future defense contracts.

Necrology

Clarence C. Carlton, 69, vice president and secretary, Motor Wheel Corp., died in Lansing, Mich., on June 9.

First and



12-inch (No. 12) Involute
Measuring Instrument

12-inch (No. 12H) Lead
Measuring Instrument

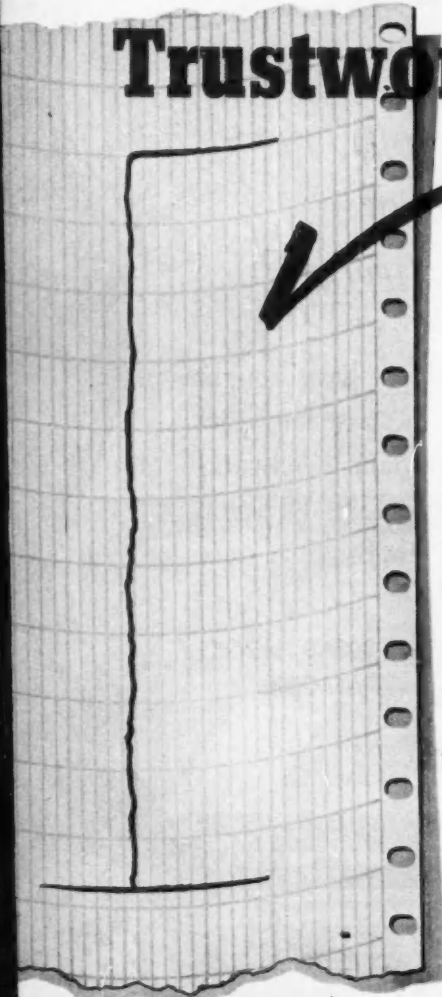
*A time saver also in setting
up shaving machines on both
spur and helical gears.*

24-inch (No. 24) Involute
Measuring Instrument

GEAR SHAPERS
SHAVING MACHINES
THREAD GENERATORS
CUTTERS AND SHAVING TOOLS
GEAR INSPECTION INSTRUMENTS
PLASTICS MOLDING MACHINES

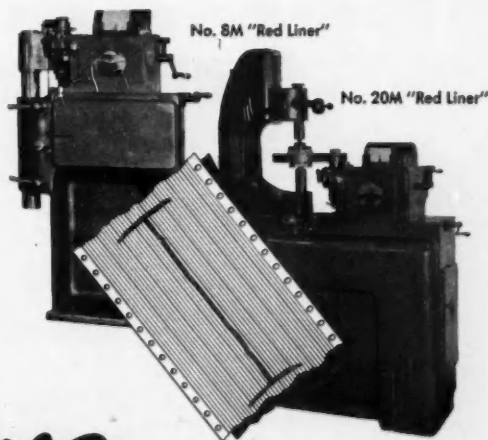
Foremost...comes

Trustworthy Inspection



**That's why Fellows makes all
its Gear Inspection Instruments
of the precision recording type**

On tooth-form accuracy depends smoothness of gear action... quiet operation... sustained load-carrying capacity... everything you ask of a top-quality GEAR. To fix responsibility beyond question, you will want simple, reliable, automatic-recording Inspection. Fellows builds a line of Instruments of exceedingly practical advantage. Set up procedure is of time-conserving simplicity. Mechanisms combine extreme sensitivity with protected ruggedness. Electronic recorders chart errors greatly magnified, for studied analysis and the location and amount of any departure from theoretical perfection. Call on us for descriptive literature on any of the Instruments pictured here. Each will handle external or internal gears to the capacities noted.



Fellows

THE FELLOWS GEAR SHAPER COMPANY • Head Office and Export Department • 78 River Street, Springfield, Vermont
Branch Offices: 616 Fisher Bldg., Detroit 2 • 5835 West North Avenue, Chicago 39 • 2206 Empire State Bldg., New York 1



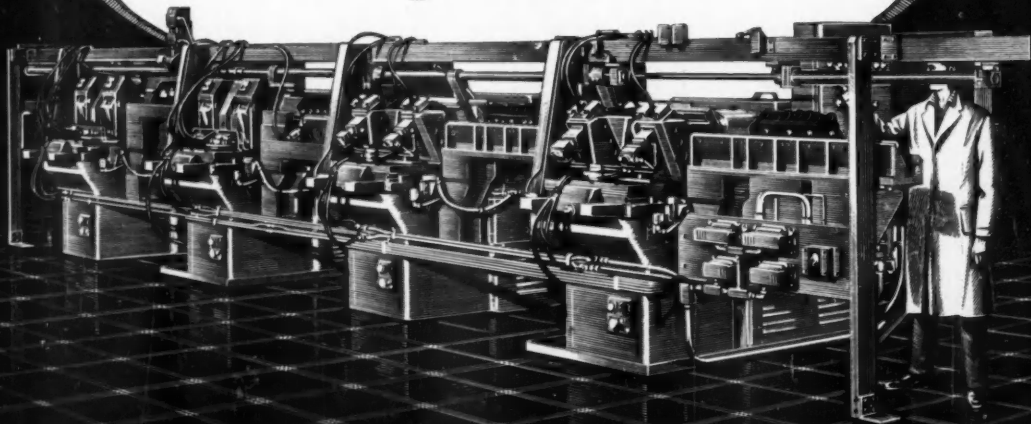
*What names come to your mind
when you think of
progressive manufacturing?*

MOST of the ones you think of first have bought New Britain Automatics within the past few years for new and better ways of doing important metalworking jobs. The New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Conn.

**AUTOMATIC BAR AND CHUCKING MACHINES • PRECISION BORING MACHINES
LUCAS HORIZONTAL BORING, DRILLING AND MILLING MACHINES**

NEW BRITAIN

Automatics



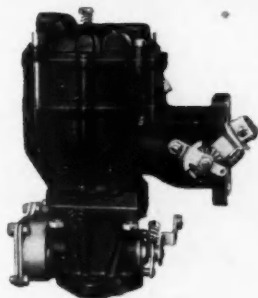
Does He Knock or Boost Your Truck?



IT ALL DEPENDS
ON PERFORMANCE
and
PERFORMANCE
DEPENDS ON

Zenith

CARBURETORS



What drivers and operators say about your vehicles has a mighty important bearing on the future of your business. So it is imperative that every component be selected on the basis of its contribution to lasting, satisfactory performance. In the field of heavy duty carburetion Zenith* has long been recognized as the engineer's choice for quality performance under all operating conditions. You can be sure that manufacturers whose vehicles are Zenith equipped measure carburetor costs in lasting terms rather than initial expense. Zenith's rugged construction, strong idling, freedom from stalling and obedient response to every power demand goes a long way toward building owner good will. That's why cost conscious operators and experienced drivers prefer Zenith equipped vehicles.

*REG. U.S. PAT. OFF.

ZENITH CARBURETOR DIVISION OF

696 Hart Avenue • Detroit 14, Michigan



Export Sales: Bendix International Division, 73 Fifth Avenue, New York 11, N. Y.

We make them
as if we were going to use them



Precisely controlled heat treating is just one of the steps taken at Accurate to assure adherence to your specifications.

... and it lowers
the overall cost of your springs

HERE at Accurate we make springs the way we'd like to have them made for us if we were the user. We believe this guarantees you the best possible springs—uniformly RIGHT springs that permit maximum assembly rates and reduce the number of rejects due to faulty operation. It all adds up to lower manufacturing costs and better product performance for you.

Plan now to find out more about

Accurate spring service and try Accurate on your next job. ACCURATE SPRING MFG. CO., 3810 W. Lake Street, Chicago 24, Ill.

Ask for your free copy of the new revised Accurate Handbook of Technical Data on Springs. This booklet has been out of print for some time and if you have previously asked for a copy and have not received it, we would appreciate your asking again.



*Be sure the
springs you
buy are
Accurate*

Accurate

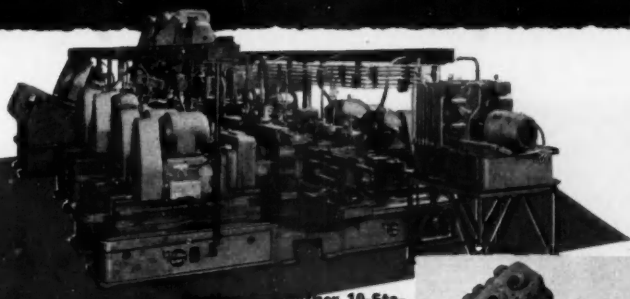
Springs

*Springs
Wire Forms
Stampings*

104 CYLINDER HEADS PER HOUR

ON W. F. and JOHN BARNES 3-SECTION "PROGRESS-THRU" MACHINE

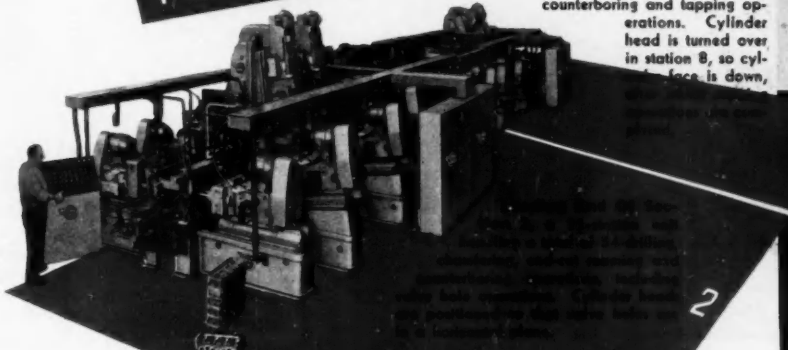
Leading-End Of Section 1...
accepts...
station...
total of 112...
and...
side of machine.



Another 10-Station Machine, is connected to Section 2, and performs a total of 85 drilling, end-cut reaming, counterboring and tapping operations. Cylinder head is turned over in station 8, so cylinder face is down,



Bottom and top view of V-8 automobile engine cylinder heads. Operations are performed in both sides and top and bottom.



224 MACHINING OPERATIONS COMPLETED AUTOMATICALLY

• A total of 224 individual machining operations are completed automatically on these special W. F. & John Barnes machines recently built to speed production of V-8 automobile engine heads. Individual machining operations include 104 drilling, 12 combination drilling and countersinking, 12 boring, 25 tapping, as well as taper and end-cut reaming. Specific features of the machines consist of three turn-over fixtures for dumping chips and re-positioning the work pieces, separate automatic lubricators to all fixtures and operating units, built-in chip conveyor, and hydraulic and electrical circuits designed for accessibility and easy maintenance according to J. I. C. standards. You can depend on Barnes to give you the latest in cost-cutting ideas and machining techniques.



Close-up view showing design of re-positioning fixture. Mechanism is hydraulically actuated and electrically controlled by limit switches. Operation is automatic.



ENGINEERING ASSISTANCE When you need help with your machining problems, feel free to call on Barnes engineers for assistance without obligation. For data on the range of special machines and equipment built, and the service developed over a period of 75 years, write for free copy of brochure "Creative Machine Engineering and Manufacturing".



W. F. & JOHN BARNES COMPANY
312 S. WATER ST., ROCKFORD, ILLINOIS

MULTIPLE SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC PROGRESS-THRU AND TRANSFER TYPE MACHINES

Upholstery Requires



(Above) Power knives are used to cut upholstery in the body trim plant. As many as 150 layers of lightweight headlining cloth may be cut at one time.



(Below) Part of the sunshade visor production line. These fabric covered sunshades are one of the many uses of cotton and cotton fabrics in automobile body production.



ONE of the most advanced facilities of its kind to be found in the industry is at the Cut and Sew Department of the Fisher Body-Pontiac Division. The large number of operations—approximately 700—and the 60 variations in Pontiac body trimming styles make a complete description of the setup impossible within the limits of this article, which is confined to some of the more important procedures.

After cloth is received it is stored adjacent to the cutting tables. Shading is facilitated by an aircooled color identification lamp using six 1000-watt bulbs. Code markings designating shades are stapled to the cloth bolts which are then moved to six 100-ft cloth laying tables. Laying machines on steel rails move over the tables evenly piling cloth layer on layer. For maximum efficiency during a single cutting 150 layers of lightweight headlining cloth are used, 125 layers of medium weight sidewall cloth, 100 layers of seat material and 40 layers of art leather.

Durable parchment is used for stenciling-in cloth patterns which are drawn in yellow crayon rather than chalk to keep the vibrating power knives from blurring the markings. Straight edge power knives cut the cloth at 3600 rpm.

Headlining marked for listing wires is cut into three pieces and placed adjacent to an operator who simultaneously joins the pieces and sews the listing on a 147 Class chainstitch machine. An underfolding mechanism developed by Fisher Body guides the listing material so that it meets the headline cloth directly under the size 23 needle.

Where there is no simultaneous joining operation, listing is fed over the top of a 400W lockstitch machine and sewn with a nylon thread and a size 22 needle.

700 Operations

Headlines are rolled on bolts and conveyed to the body assembly line where wires are inserted in the listing to hold the headlining to the roof panels.

Due to the variety of complex operations and the heavy materials used, sewing machines are operated at between 2200 and 4500 stitches per minute although their rated speeds are considerably higher. Some 50 per cent of the 280 sewing machines used on Pontiac trimming are 111W155 lockstitch machines for general sewing of cushions, seat backs, door paneling and side paneling.

In trimming front and rear seat fronts on standard cars the 111W155 joins three pieces of cloth to form the top half which is then pocketed by radius sewing. Top and bottom sections are joined and welted on a 147 Class chainstitch which simultaneously stitches a cloth covered wire into the welting. Listing is lockstitched to the under side of the weltlip and the wire is later hogringed to the seat frame.

Halves of the bottom section are French seamed on a 147-110 two-thread chainstitch machine which is also used to join the art leather side facings. For its bolster type button back cushions Fisher Body has developed a button tufting machine which automatically joins and tufts buttons at the rate of 16,000 per day. Formerly the old foot operated kick-presser type machines turned out only 1600 per day — an increase of 10 to 1.

Front and back cushion bolsters are lockstitch joined and then French seamed. Side facings are processed in the same manner.

At the Pontiac Fisher Body plant over 100 miles of thread are sewn every day. Cotton thread of the 16-4 and 20-4 variety is used

(Turn to page 90, please)



(Above) Front seat cushions flow down the chute at the right and are transferred to seat frames shown on the assembly line at the left.



(Below) The pushbutton-controlled power arm shown here eliminates most of the effort which would otherwise be required to lift a front seat assembly into a body.



By
James R.
Custer

Military

REQUIREMENTS for military transport vehicles, construction of current automatic transmissions, and combustion chamber deposit problems were the technical topics to receive the greatest amount of attention at the Summer Meeting of the Society of Automotive Engineers. Again this annual event, held the first week of June at French Lick, Ind., attracted a record attendance of automotive engineers from various sections of the Nation and Canada. Committee meetings were another important activity for the members during the week.

The *Daily SAE*, discontinued 20 years ago, was revived as a four-page early morning tabloid and made a big hit, keeping the members and guests informed of the latest SAE news and reviews of past affairs. Four companies sponsored it, one each day in the following order: The Timken-Detroit Axle Co., Pontiac Motor Div. of General Motors, Adhesives and Coating Div. of Minnesota Mining and Manufacturing Co., and the Bendix Aviation Corp.

Garrison Manufacturing Co. of Los Angeles, Calif., demonstrated its power assist steering installed on an Oldsmobile 98. There is an increasing interest in servo steering mechanisms for passenger cars, with several companies now engaged in their development. Chrysler adopted one type as regular equipment on a 1951 model and is offering it as optional equipment on two other models.

Twelve technical papers were presented at morning,

afternoon and evening sessions, and also scheduled was the same number of round table discussions of current problems, such as plastic models techniques for bodies, truck transmission synchronizers, frame versus frameless body construction, aircraft engine lubrication, and automobile noise and vibration. Designs of two new automotive engines—the Cummins high speed experimental Diesel and the Studebaker V-8 (see *AUTOMOTIVE INDUSTRIES*, Nov. 1, 1950 issue)—were analyzed by top engineers of those companies.

The technical sessions got off to a successful start on June 4 with the paper, "Military Wheeled Transport Vehicle Requirements," which was given by Colonel W. A. Call, chief of the Development and Engineering Dept. at the Ordnance Tank-Automotive Center, Detroit. He described the several military wheeled vehicles now in production and also those under development, pointing out that wheeled vehicles of proper design are superior in performance and cost less than comparative tracked vehicles for cargo transport use. To illustrate this contention he compared the new T51 cross country carrier with two World War II vehicles—the four ton 6x6 cargo truck and the M8 cargo tractor. Their characteristics are listed in the accompanying table. After the session seven of the latest Army trucks, including the huge T58 which is illustrated in this article, were displayed and demonstrated for the engineers. Their specifications are given in Table I on page 36.

Most of the second day program was devoted to combustion chamber deposits, their causes and effects. Following two papers in the morning, abstracts of which accompany this article, there was



The T58, one of the military vehicles demonstrated at the SAE French Lick meeting. This 15-ton 8x8 unit, powered by a 540 hp air-cooled engine located back of the cab, is under development at the Detroit Arsenal for cargo and tractor applications.

Vehicle Developments

Designs of Army Wheeled Transports Disclosed at SAE French Lick Meeting; Technical and Round Table Sessions Devoted to Timely Engineering Problems

a forum in the afternoon with a panel of experts available for questions on specific problems.

The symposium on automatic transmissions and torque converters was one of the largest technical sessions of the week. Current designs and their operation were analyzed by experts from companies now manufacturing them. Of particular interest was the announcement that the Hydra-Matic transmission soon will be equipped with a variable capacity vane type pump, which will reduce operating temperatures, increase fuel economy, minimize internal leakage, and provide less operational variance due to temperature

change. It will replace the gear type pump.

Wells Coleman, of the Gleason Works, explained a new method for determining the fatigue life and loading of gears, which aids in designing them for the most efficient use of materials. How the bonded wire strain gage, brittle lacquer, and structural fatigue machines are utilized in determining loads and stresses for machine design was reviewed by F. G. Tatnall, manager of testing research, Baldwin-Lima-Hamilton Corp. These methods, he stated, make possible product improvement before use. Special extracts from some of the important papers accompany this article.

Military Wheeled Transport Vehicle Requirements

By Col. William A. Call

Chief, Development and Engineering Dept.,
Ordnance Tank-Automotive Center

A GREAT number of vehicles are used by the military forces within the limits of the United States and in its possessions. As a result two distinct types are required—the administrative vehicle and the tactical vehicle. To a great extent, the administrative vehicle, be it a sedan, truck or motorcycle, is a standard commercial item. These administrative vehicles are not required to operate over rough ground or off the road.

Tactical vehicles, however, present an entirely different problem. These are "all-wheel-drive, off-the-road" vehicles for the troops in the field. They are entirely dependent for their spare parts upon the supply pipeline flowing continuously from the United States to the battle fronts by means of overcrowded shipping or airlift. In this situation, the number and quantity of

Major Performance Requirements for Army Tactical Vehicles

1. Ability to climb a 60 per cent slope with rated load—this slope to consist of a natural, unpaved hill.
2. Maintain a reasonable road speed compatible with the size of a truck. Regardless of size, it will have to be capable of sustained operation at 35 mph or better.
3. Capable of continuous operation on a 20 per cent side slope.
4. Travel 300 miles at 30 mph without refueling.
5. Ford streams with the water up to the driver's neck.
6. Differentials must provide drive to all wheels having traction.
7. A full floating axle is desirable.
8. Maximum obtainable ground clearance, and at the same time, the following requirement.
9. Lowest possible silhouette.
10. Able to operate with flat tires without losing the tires.
11. Able to operate at any temperature between -85°F . and $+125^{\circ}\text{F}$.
12. Designed to be capable of being air-transportable, equipped with necessary lifting eyes and tie down hooks.

Table I—Specifications of Military Vehicles

	M38 4 x 4 1 1/4 Ton	M37 4 x 4 3/4 Ton	M34 6 x 6 2 1/2 Ton	M135 6 x 6 2 1/2 Ton	M41 6 x 6 5 Ton	T57 6 x 8 10 Ton	T38 8 x 8 15 Ton
Manufacturer	Willys-Overland	Chrysler Corp.	Reo	GMC	International Harvester	Detroit Arsenal	Detroit Arsenal
Net Weight (lb):	2,630	5,700	11,800	12,000	19,469	38,400	48,300
Gross Weight (lb):							
Cross Country	3,430	7,200	16,600	17,000	29,469	57,400	79,020
Highway	3,830	7,700	21,800	22,000	34,469	69,400	96,020
Payload (lb):							
Cross Country	800	1,500	5,000	5,000	10,000	20,000	30,000
Highway	1,290	2,000	10,000	10,000	15,000	32,000	48,000
Towed Load (lb):							
Cross Country	1,500	4,000	6,000	6,000	15,000	24,000	36,000
Highway	2,000	6,000	10,000	10,000	30,000	64,000	90,000
Wheelbase (in.):	80	112	184	158	179	188	175
Engine	Willys-Overland 134 cu in. 60 hp at 4000 rpm	Dodge 230 cu in. 94 hp at 3200 rpm	Reo 331 cu in. 145 hp at 3400 rpm	GMC 302 cu in. 146 hp at 2800 rpm	Continental 402 cu in. 224 hp at 2800 rpm	Ordinance AV-1195 1194.Scuin. 540 hp at 2800 rpm	Ordinance AV-1195 1194.Scuin. 540 hp at 2800 rpm
Transmission	3-Speed Synchro- nized	4-Speed Synchro- nized	5-Speed Synchro- mesh	Hydra- matic 8 speeds forward 2 speeds reverse	Synchro- mesh	Torque Converter Semi- Auto- matic	Torque Converter Semi- Auto- matic
Transfer Case	2-Speed Non- syn- chro- nized	2-Speed Non- syn- chro- nized	2-Speed Syn- chro- nized	Single Speed	Synchro- mesh	Built-in Trans- mission	Built-in Trans- mission

Military Vehicle

locking differentials. They will have incorporated in them a completely sealed braking system. The suspension system may be a torsion bar or some other system giving increased road clearance. To increase ground clearance even more, the future tactical vehicle will probably be equipped with extremely large and soft tires. This will not only give a better ride, but it will at the same time increase mobility over soft surfaces. The vehicles will be powered with one of the standard family of Ordnance engines now developed and being built in volume in certain sizes. These engines are in the same families as those used in our present track laying vehicles. Incorporated with

spare parts must be held to a minimum. Here, standardization is most essential, and here quality of construction to eliminate the requirements for spare parts is a very important consideration.

Ordnance engineers involved in the wheeled vehicle field fully realized when the program started that the design of the ideal wheeled tactical vehicles would be a time-consuming and complicated task. As a result of this, we initiated a dual program. One—to carry on the development of the ideal military wheeled vehicle, and two—to carry on the development of a vehicle that can be produced in quantity today. The 2 1/2 ton M34 Cargo Truck, a postwar vehicle (see Table I and AUTOMOTIVE INDUSTRIES, August 1, 1950, issue), is an example of the second objective. Other trucks in this category are a 1/4 ton, 3/4 ton, alternate 2 1/2 ton and a 5 ton, being developed by different manufacturers. Simultaneously, we are proceeding with our investigations and attempting to develop the ideal wheeled vehicles. The payoff lies not solely in the development of an ultimate vehicle, but also in the interim application to current production, of the lessons learned piecemeal and the separate components developed individually in the course of the long-range program. As indicated before, our ideal vehicles will be equipped with locking or semi-

these engines will probably be some type of torque converter or automatic transmission.

While desirable changes are being incorporated into present high volume production models, we are proceeding with the building and testing of experimental models of our more advanced tactical vehicles. It will be of interest to compare one of our tactical vehicles which is now in the pilot stage, to a World War II

Table II—Characteristics of Three Army Vehicles

	6 x 6, 4-Ton Cargo Truck W. W. II	T51 Cross Country Carrier Postwar	M48 Cargo Tractor W. W. II
Payload, tons	4	5	5
Weight—Empty—Fully Equipped	18,050	15,050	35,500
Line Crew, lb.	44	63	28
Cargo Weight to Vehicle Weight, %	96	96	117
Overall Width, in.	268 1/2	254	250 1/2
Overall Length, in.	116 1/2	109 1/2	114 1/2
Overall Height, in.	88 x 132	68 x 147	110 x 145
Body Size, in.	11 x 12 1/4	10 1/2	18 1/4
Axle Ground Clearance, in.	8 cyl in line liquid cooled	8 cyl opposed air cooled	9 cyl radial air cooled
Engine Type	128 at 2300	250 at 3000	475 at 2400
Gross Brake Hp at Rpm	40	55	38
Maximum Speed, mph	2.3 at 25	4.5 at 25	3 at 18
Grade-Speed Ability, % at mph	36	72	40
Maximum Forcing Depth, in.	180	300	200
Approximate Cruising Range, miles	No	Yes, automatic	Yes, manual
Torque Converter, Transmission	No	Yes	Yes, manual
Automatic Locking Differential	Conventional (bogie-rear)	Independent torsion bar	Controlled steering
Suspension Type	Conventional	Soled design	Individual torsion bar
Service Brake	No	Yes	External contracting
Central Inflation System	No	Yes	(Not applicable)
Generator	6 v, 25 amp	Heavy duty 24 v	Heavy duty 24 v

Developments

wheeled vehicle of similar capacity, and a World War II tracked vehicle of this same capacity. The experimental vehicle is the T51 Cross Country Carrier. This vehicle has a payload of 5 tons. The World War II wheeled vehicle nearest to this capacity was the 6x6 4 ton Cargo Truck and the nearest tracked vehicle capacity-wise was the M8 Cargo Tractor with a capacity of 5 tons. Table II shows that the cross country carrier with its payload of 5 tons weighs one ton less than the World War II wheeled vehicle and weighs less than half as much as the World War II tracked vehicle. Not shown on Table II are other advantages of this new vehicle. It provides a more comfortable ride; it is easier to drive; its maintenance is relatively simple, and it incorporates a completely waterproof, corrosion-proof, fungi-proof, dust-proof and radio-interference-proof, 24-volt ignition system.

In addition to the T51, there is under development at the present time, a class of cross-country carriers consisting of $\frac{3}{4}$ ton, 4x4, trucks, $2\frac{1}{2}$ ton, 6x6, and 5 ton, 6x6, cargo vehicles. The outstanding features of these vehicles are air-cooled, horizontally opposed engines, members of the Ordnance "Family of En-

gines" with interchangeable parts, torque converter-planetary gear transmissions and improved suspension systems. Certain special features are being tested on some of these vehicles, such as fuel injection and front and intermediate wheel steering in one of the 5 ton vehicles.

The cross-country carriers are envisaged as highly mobile vehicles which would be procured in relatively small quantities for use by front line, mobile troops. The air-cooled engine powering this group of vehicles has cylinders, pistons, connecting rods, bearings and other auxiliary parts interchangeable. This is expected to alleviate substantially our parts supply and stocking problems over the experience of World War II.

In larger vehicles, we are developing 8x8 trucks with capacity of 10 and 15 tons. These vehicles provide good load distribution and an excellent ride due to the additional bogie in the front as well as the usual bogie at the rear. They are equipped with air-cooled engines and torque converter-planetary gear transmissions. These larger vehicles utilize an eight cylinder V-type air-cooled engine with the same piston, connecting rod and basic cylinder as is used in the tanks and the self-propelled artillery. These 8x8 trucks are demonstrating their ability to go anywhere a tank can and are expected to be produced in both tractor and cargo versions; the one to be utilized for towing semi-trailers and the other to serve as a prime mover for heavy towed artillery.

An Improved Method for Estimating the Fatigue Life of Bevel and Hypoid Gears

By Wells Coleman

Gleason Works

BY plotting the results of fatigue tests on automotive spiral bevel and hypoid rear-axle gears as well as the results of tests on Zerol bevel and spiral bevel miter gears, two graphs were obtained. Nearly all of the points represent the results of tests on case-hardened gears, including both ground and unground teeth. About a dozen points represent the results of tests on flame-hardened teeth. By superimposing the two graphs the result is shown in Fig. 1. Note that these two coincide very neatly. If we are interested in average life, a line might be drawn through the middle of these points. However, most designers are interested in a minimum life. This is especially true in aircraft design where it is desired to design as close to the safe limit as possible. Accordingly, we have drawn a line in such a position that not more than five per cent of all test failures are below it. As drawn, the slope of this line is approximately 5.68 and the endur-

ance limit has been selected at a stress of 30,000 psi which corresponds to a fatigue life of about 6,000,000 cycles. Mathematically, this line may be expressed by

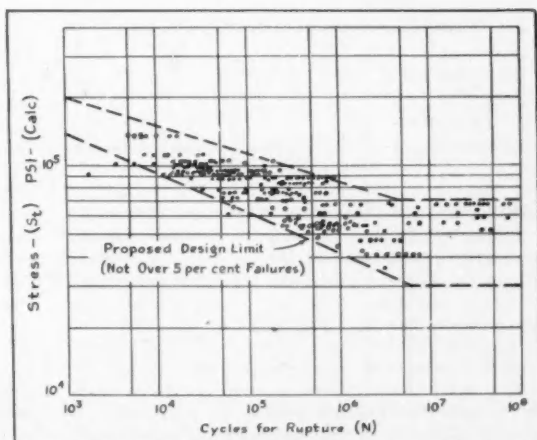


Fig. 1—Results of fatigue tests on gears.

Military Vehicle Developments

the following equation:

$$N = \left(\frac{468,000}{s_t} \right)^{5.68}$$

where N = approximate minimum fatigue life in cycles.

s_t = maximum tensile stress.

Special attention is called to the fact that not all jobs will fall on this minimum line, nor will they spread horizontally across the entire band of points. To illustrate, on the horizontal line representing a stress of 70,000 psi the fatigue life varies within the scatter band from approximately 50,000 cycles to 4,500,000 cycles. One design, as shown, lies between 65,000 cycles and 450,000 cycles, while a second design

might lie between 200,000 cycles and 2,000,000 cycles. The spread for one design rarely will exceed a ten-to-one ratio.

This method of fatigue life determination offers a means for comparing various designs of bevel and hypoid gears and for estimating their life. The attempt has been made to include as many factors as possible in order to cover the large number of variables in gear design. It is only by using such an approach as this that comparisons may be made between various tooth forms and gear mountings.

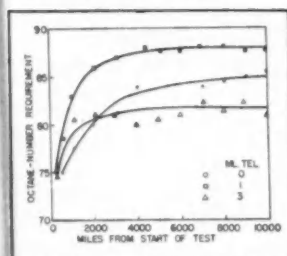
Further simplification is possible for the designer of commercial gears where large factors of safety are tolerated. But this simplification is of little value to the man who must design for the most efficient use of materials.

Effects of Combustion Chamber Deposits on Octane Requirement and Engine Power Output

By J. B. Duckworth

Standard Oil Co. (Ind.)

Fig. 2—Change in octane-number requirement with TEL content and test mileage



Test Cars from Popular-Price Field

Car	Valve Arrangement
A-1, A-2	Overhead
B	L-Head
C-1, C-2	L-Head
D	L-Head

Table 3
Effect of TEL Content on Octane-Number Requirement

TEL Content, mi. per gal.	Initial Requirement			Requirement After 10,000 Miles					
	0	1	3	Deposits Present			Deposits Removed		
Car				0	1	3	0	1	3
A-1	74.5	75.5	74.5	85.5	87.5	81.5	75.0	75.0	79.5
A-2	73.5	74.5	72.5	86.0	87.5	83.5	75.5	73.0	76.0
B	72.5	68.0	69.5	84.5	75.0	79.5	72.5	64.5	69.0
C-1	71.5	73.0	75.0	83.0	87.5	83.5	72.0	78.5	73.5
C-2	72.5	75.5	76.5	82.0	85.5	82.0	79.0	75.5	76.0
D	53.0	60.0	—	68.5	74.5	—	55.0	59.5	—

not have altered the results by a significant amount.

Octane requirements for all cars are summarized in Table I. These results take into account initial and terminal requirements and, in addition, octane-number requirements after deposits had been removed from the combustion chamber. For cars of the same make and model, initial octane requirements are in good agreement. By and large, requirements of duplicate cars after 10,000 miles of operation on each of the test fuels are in reasonable agreement. As might be expected, there were considerable differences between cars of different makes.

Changes in torque accompanying deposit removal indicate that the effects of deposits range all the way from a gain in torque of six percent to a loss of more than nine percent. Part of these differences may be attributable to differences in combustion-chamber design. In the case of Cars A-1 and A-2, TEL content was not a significant factor with respect to torque change. With respect to Car B, torque loss becomes

(Turn to page 102, please)

PROGRESSIVE changes in octane requirement for three test fuels in Car A-1 are shown in Fig. 2. The curves are typical of the octane-requirement build-up for all cars tested under these particular conditions of operation. The most rapid increase occurred during the first 4000 miles of operation for the leaded fuels. The shape of the leaded-fuel curves suggests that a state of equilibrium was reached at roughly 5000 miles. There is some indication that the unleaded fuel had not reached its peak requirement at 10,000 miles, but additional mileage would

METALS

Steel Scrap Shortage May Become Still Tighter; CMP Faces Different Conditions Than During World War II

By William F. Boericke

The Steel Pinch

Steel ingot production continues at a record breaking rate, currently over 2,060,000 tons per week. It may drop off during the hot summer months because of the vacation period but a lot of workers prefer to stay on the job and draw bonus pay. Steel executives are more worried over a scrap shortage which may become tighter later in the year.

Sharp differences of opinion exist regarding steel supply for civilian use in the third and fourth quarters after providing for military needs and defense supporting orders. According to General Motors president, C. E. Wilson, the worst pressure of the defense program is likely to be felt in the third quarter with some relief before the end of the year. Military use of steel is a much smaller percentage of total output than is generally believed, he declared. Much the same thing has been expressed by Walter S. Tower, president of the American Iron & Steel Institute, who estimates that 90 per cent of the 1951 steel output or some 104 million tons will be available for what are generally regarded as civilian requirements.

The discrepancy between these assertions and Government predictions of a 75 per cent need of steel for direct and indirect defense needs is largely a matter of terminology. The Government includes steel for freight car, oil drilling, pipe lines, and plant expansion under defense categories but the steel executives list them under civilian requirements. The best estimate for direct military use of steel in the third quarter is about 700,000 tons of finished rolled products per month, or only one-eighth of the prospective supply.

At the present time steel plant capacity is being expanded to reach a lofty 118 million tons by the end of 1952. That represents a 20 per cent increase of capacity before Korea. To do this about 10 per cent of current steel output is being used for new construction. With its completion, not only will some 18 million tons of new steel be provided but 10 million tons now going into construction will be freed for other uses. Iron and steel companies will spend about \$1.2 billion on plant construction in 1951.

Pittsburgh Short on Steel

But steel consumers particularly in the Pittsburgh area are confronted today with a condition and not a theory. They are definitely short of steel for war re-

quirements and are not convinced by steel executives that no real shortage impends. NPA has limited the use of steel in consumer durables other than automobiles to 70 per cent of the pre-Korean level for the third quarter. This represents a deeper cut than the 8.0 per cent permitted for the second quarter. The new steel order exempted from steel restrictions other than automobiles, small manufacturers using less than three tons of carbon steel and less than 1000 lb of alloy steel in the third quarter.

Without much doubt a steel shortage presently exists, although it is probable that a good deal of the enormous output since the first of the year has been going into inventories. Business accumulations of inventories appears now to have passed its peak. It has been pointed out that in the history of this country every severe shortage in a raw material has been turned into a surplus in an unbelievably short time. The shortage usually seemed most severe just before the market turned from a sellers' to a buyers' market almost overnight. This may not happen in today's steel market but it's worth some thought.

Contradictory Attitude of OPS

The attitude of officials of the Office of Price Stabilization has been contradictory. The agency has sternly frowned on any industry-wide price boost for copper although countenancing the three-cent higher price for Chilean copper sold in this country. It was declared that users of Chilean copper would have to absorb the higher price they pay for that metal as best they could.

On the other hand the agency apparently gave quick consent to the six-cent increase instituted by International Nickel Co. which brought the price of nickel up to 56¼ cents per lb and permits distributors and producers of products containing more than five per cent nickel to pass the increase along to their customers. Shortly afterwards an agency official declared that price controls will be lifted on manganese, chromite and several other strategic raw materials, in order to step up the Government's mineral program as well as to permit American buyers to meet the prices being paid for manganese abroad. The General Services Administration which buys for the stockpile will be authorized to contract with domestic producers at above ceiling prices without further clearance from OPS.

This is sound reasoning to bring a supply of badly wanted manganese into this country but it is difficult to see why it does not equally apply to copper, lead, and zinc as well. The price situation on copper is badly

(Turn to page 88, please)



This Republic XF-91 high speed, high altitude interceptor features inverse wing taper with variable wing incidence permitting changes of angle of attack in flight. It is powered by a turbojet engine and rocket motors. Final USAF tests are to be made soon.

This Grumman triphibious SA-16, now in production at the Bethpage, Long Island, plant for the USAF Air Rescue Service, is designed for operation on water, land, snow or ice. For use on snow or ice, it is equipped with a single shock absorbing retractable skid attached to the keel, and auxiliary skids below the wing tip floats.

Latest



Bell X-5 with variable sweptback wings. This experimental aircraft is now at Edwards Air Force Base, Muroc, Calif., where it soon will be used to obtain transonic flight data. For take-off, climb and landing, best performance is with the wings in a forward position. At higher altitudes, greater speed is possible by increasing the degree of sweepback, as in this photo. It is powered by a 4900 lb thrust Allison J-35-A-17 turbojet engine mounted under the cockpit with the tail pipe protruding beneath the fuselage. This craft has a length of 33 ft four in., height of 12 ft, wing span of 32 ft nine in., and weighs approximately 10,000 lb. It was developed by the Air Force, NACA and Bell Aircraft engineers.

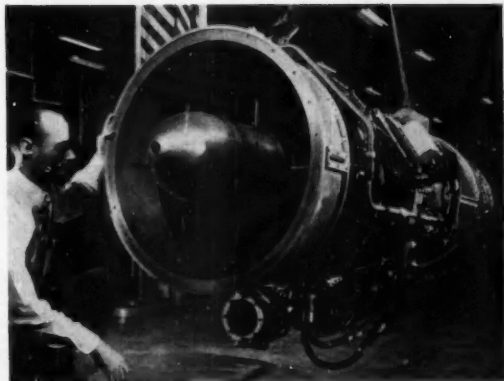
Closeup of the Martin XB-51, U. S. Air Force tactical bomber, which is powered by three General Electric J-47 turbojets, each producing more than 5000 lb thrust. In addition to the two jet engines mounted on pylons beneath the cockpit, the third is in the rear of the fuselage. Speed of this experimental bomber is reported to be comparable with that of a modern jet fighter.





Warplane Designs

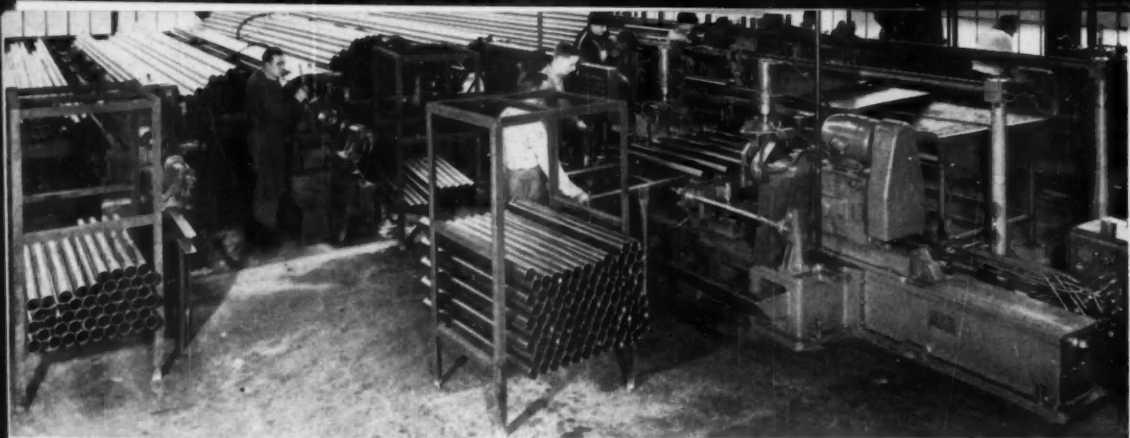
General Electric's latest turbojet engine, the J-47-GE-21, which is the first of the advanced J-47 axial flow series and is designed for advanced military aircraft. Its thrust, which is a military secret, is reported to be considerably greater than current J-47 engines rated in excess of 5200 lb. Note accessories on the underside, which have been placed there to provide greater air inlet area to the compressor. The engine is 36.75 in. in diameter, and 146 in. long, and has the cannular type of combustion system. With modification of accessory mountings, and other minor changes, the "21" will become the J-47-GE-29. Addition of an afterburner forms the J-47-GE-31.



Here is the latest Republic Thunderjet fighter, the first operational jet fighter to be equipped for mid-air refueling by tanker planes, which can be accomplished in 2 1/2 minutes by the Boeing flying boom system. The improved Allison J35-A-29 turbojet powerplant delivers 5600 lb thrust. This plane is the first F-84G to come off the production line. The F-84F model, being prepared for production at the General Motors Kansas City plant, is a swept wing, swept tail fighter-bomber and is to be powered by the Sapphire turbojet engine having 7200 lb thrust.

Navy's newest anti-submarine aircraft, the Grumman AF-2W & AF-2S Guardian are pictured in "hunter-killer" operational formation. Both models are powered by a Pratt & Whitney R-2800 engine. A high priority project, no specifications have been released.





View in a corner of the tube mill, the Yoder mill being located against the wall in the background. In the foreground is the W. F. & John Barnes machine for facing and chamfering the ends of tubes.

Wide Variety of on the

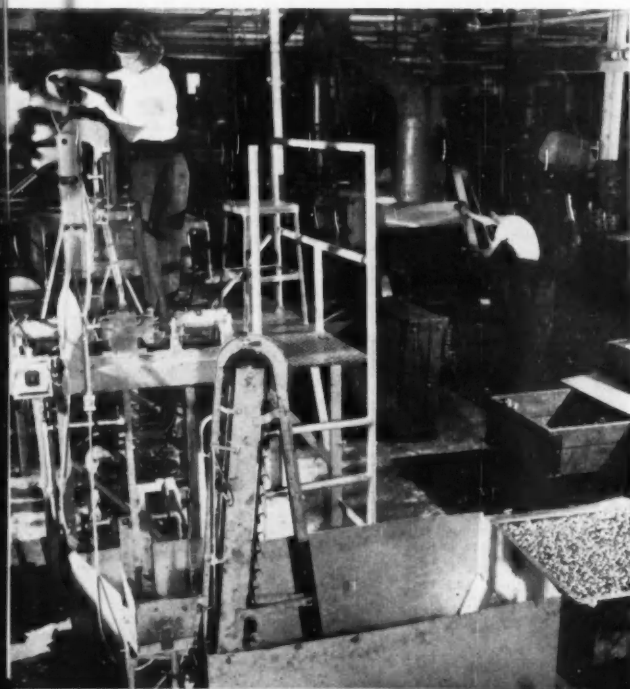
RECOGNIZED as one of the outstanding producers of universal joints for passenger cars and trucks, Universal Products Co., Inc., Dearborn, Mich., is currently manufacturing the well known Detroit line of universal joints, including the ball-and-trunnion type; self-aligning joints; the combination series of ball and trunnion and cross type joints;

and cross type, and bearing block cross type models.

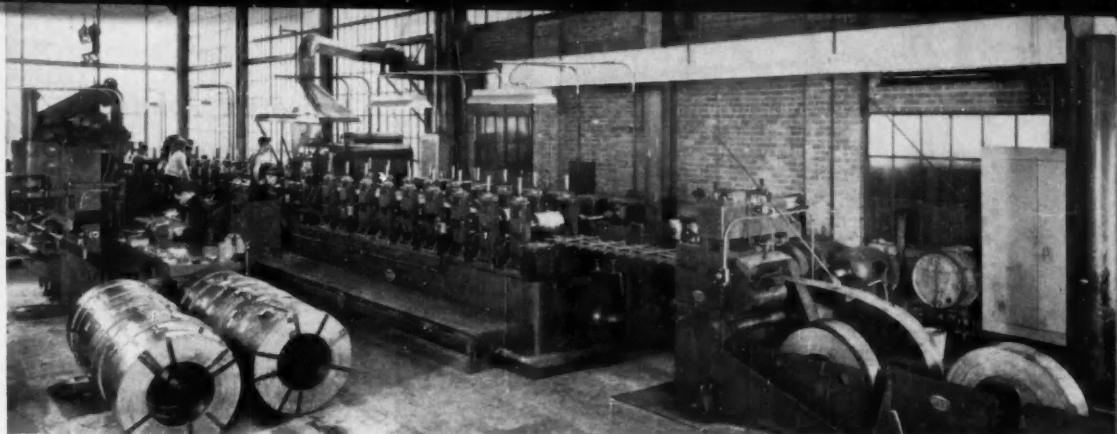
These are produced in a modern plant of some 277,000 sq ft floor area, a self-contained operation comprising some 625 machine tools of all kinds. Quality control, close holding of manufacturing tolerances, accurate tube fabrication, and exceptionally fine assembly fits contribute to the fine running balance and durability of Detroit universal joints. It is significant in this connection that total backlash of passenger car type involute splines is of the order of 0.0003 in.; while overall backlash for ball-and-trunnion type assemblies is held to 0.006 in.

Overall balance is readily held to one oz-in. at 3400 rpm for large truck propeller shafts, and to ½ oz-in. for larger passenger car assemblies. Dynamic balance of such assemblies is confirmed by inspection in one of the latest GMR machines, illustrated here.

Quality control is impressed on the



Machine for checking soundness of ball elements of ball-and-trunnion joints.



This is the big Yoder steel tube mill which produces all of the tubing required for the operation. Tubing is produced at a rate of around 75 fpm.

Universal Joints Production Line

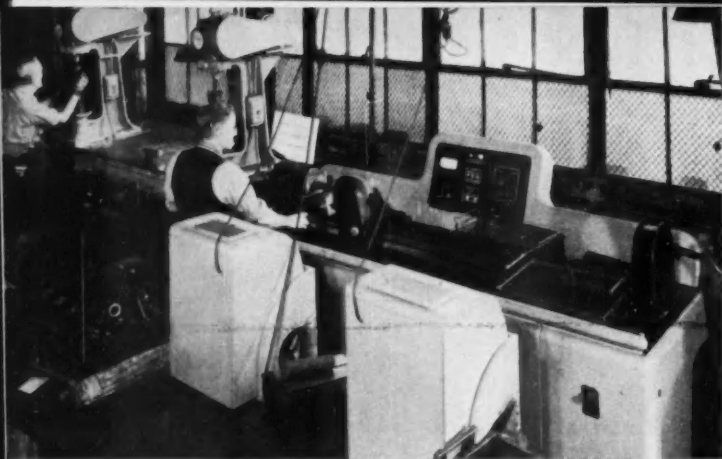
By
Joseph
Geschelin

basic raw materials and forgings since most of the component parts are subject to high stress loading. To assure freedom from seams and cracks and other imperfections, forgings and most finished ferrous parts are subjected to a sampling inspection.

(Right) Here is one section of the propeller shaft assembly line. Operators may be seen adding component parts as the shafts pass their station.



(Left) Large propeller shafts, including those made for truck applications, are given a dynamic balance test in the familiar GMR balancer seen in this view.



Universal Joints on the Production Line

The large Magnaflux Magnaglo machine, shown here, is in constant use for sampling the soundness of the multiplicity of ferrous parts.

tion in one of the latest Magnaflux Magnaglo machines shown here.

Supplementing the comprehensive machine shop and heat treating facilities is an extensive tube mill equipped to produce all of the tubing used in propeller shaft assemblies.

In view of the details of this extensive operation, this article is intended to cover only some of the highlights to provide the reader with a perspective of what goes on from start to finish. One significant point is that all round bores and splined bores are broached; while all external formations are handled in the familiar vertical hydraulic broaching machines. Through proper design of product and tooling, surface broaching has provided excellent dimensional control coupled with good manufacturing economy. At the present time there are in use 10 Colonial broaching machines, two Cincinnati Hydro-Broach units, three LaPointe, and two American broaches.

On assemblies employing involute splines, the internal involute splines are produced by broaching to extremely close tolerance. External splines on the yoke end are cut in a new eight-spindle Cleveland hobbing

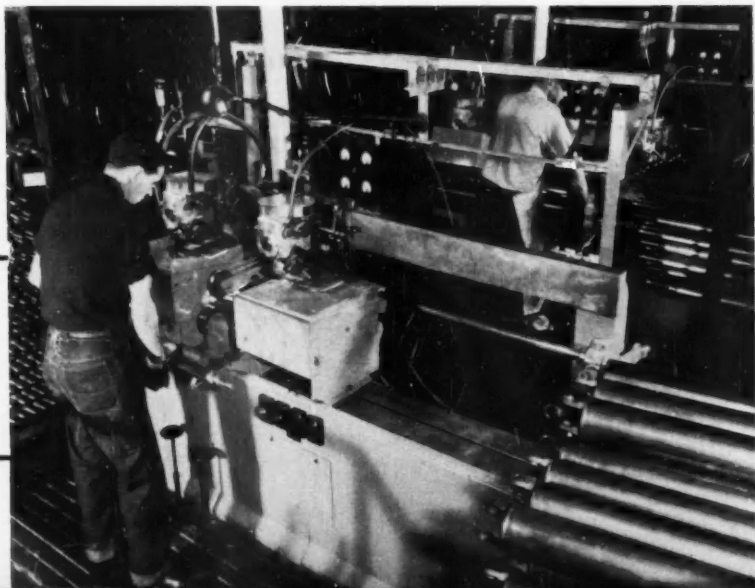
machine, distinguished by the provision of an automatic continuous shift hob mechanism. Automatic timing of hob shift

assures uniform wear and uniform performance, and simplifies hob sharpening. After hobbing, the external spline is finished in rack-type Michigan Tool shaving machines. This procedure assures the mating of splines both on the OD and PD and is responsible for the ability to hold backlash within 0.0003 in.

Impressive in its operation is the "bounce" machine for checking the soundness of the ball elements of ball-and-trunnion joints. The balls are carburized and hardened to R_c 60 and must be absolutely free from seams or surface cracks that might contribute to fatigue failure. The "bounce" machine inspects automatically and at high speed. These so-called balls are not actually spherical in shape, as each has a comparatively large hole through its center.

Looking at the illustration it will be noted that the only function of the operator is to keep the hopper constantly filled. The "bounce" cycle is in the form

(Turn to page 110, please)



Close-up of one of the special resistance welding machines used for seam welding yoke ends to the tubing. Electrical machinery and controls are housed below the floor.

Swing Type Intake Valves

High Speed, Aircooled Race Engine With Special Intake

Valves of Unique Design Weighs 180 Lb and Develops 225 Hp.

By W. F. Bradley

Special European Correspondent
for AUTOMOTIVE INDUSTRIES

AN outstanding feature of a 122 cu in. aircooled flat-four racing engine produced by the Butterworth Engineering Co., of England, is the use of a "swing valve" for the intake. This design allows a freer flow of gas into the combustion chamber, thereby improving efficiency. Having practically no stem, the valve head is attached to the arm of a rocker which protrudes into the inlet port and is pivoted on a shaft. When the valve is opened it swings away to one side of the port, within the cylinder, leaving a practically straight path for the passage of the charge. The rocker is profiled to reduce resistance.

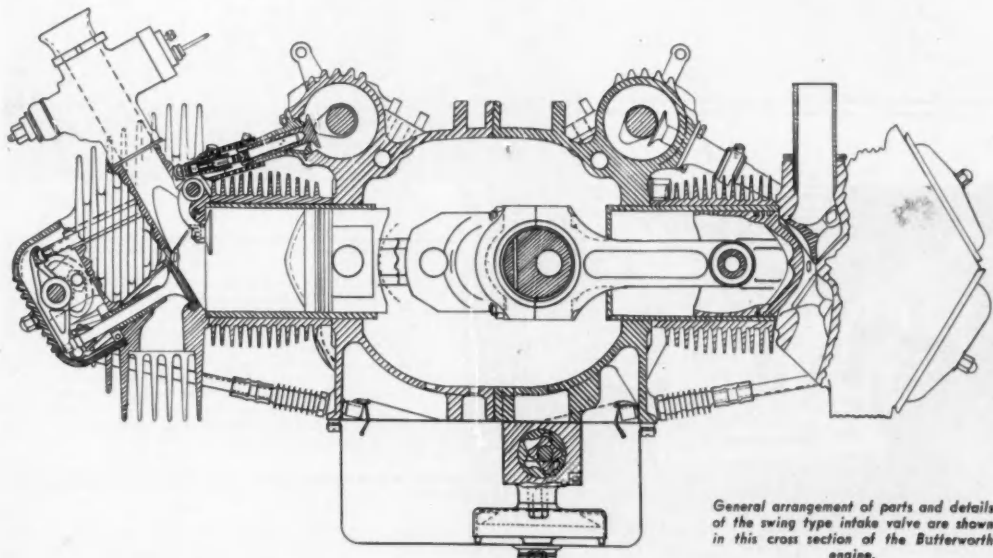
Exhaust valves are conventional poppet type, inclined in the head and operated by push rods and rockers. Diameter is $1\frac{1}{2}$ in. and opening 0.380 in. The swing type intake valve also has a diameter of $1\frac{1}{2}$ in.

The engine has a bore and stroke of 3.45 by 3.25 in., the cylinders being separate with finned barrels made

under the Al-Fin process. They are carried on a light-alloy crankcase. The Nitralloy crankshaft is mounted in three plain bearings of 2.5 in. diameter. There are two cam-

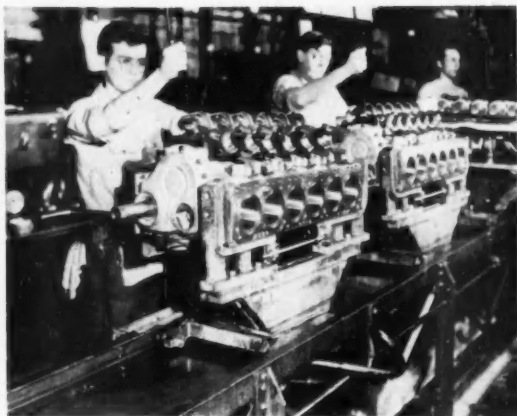
shafts, each driven by light alloy gears. The cylinder heads are Al-Fin construction with "spectacle" iron inserts for valve seats and spark plug bushings. The H-section connecting rods are light-alloy, machined all over. The flywheel is Al-Fin steel aluminum-construction, with a nine in. Borg & Beck clutch.

Each cylinder has its own $1\frac{1}{4}$ in. Amal downdraft carburetor. A wet sump is used, with connections for an oil cooler. It is claimed that dry weight is 180 lb, and that the output of the swing valve type is 225 hp. A more conventional type develops 180 hp at 6000 to 7000 rpm. Valve timing is as follows: Inlet opens 48 deg before TC, closes 68 deg after BC; exhaust opens 70 deg before BC and closes 46 deg after TC. Patents have been secured for the swing valve in many countries.



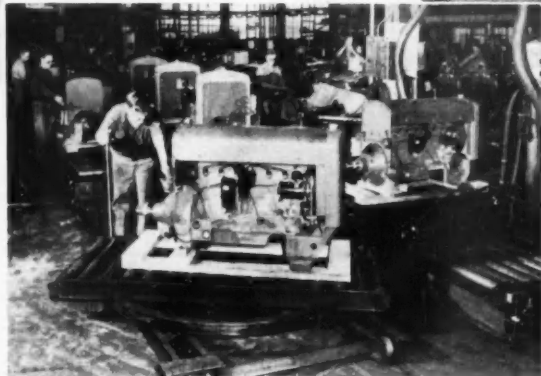
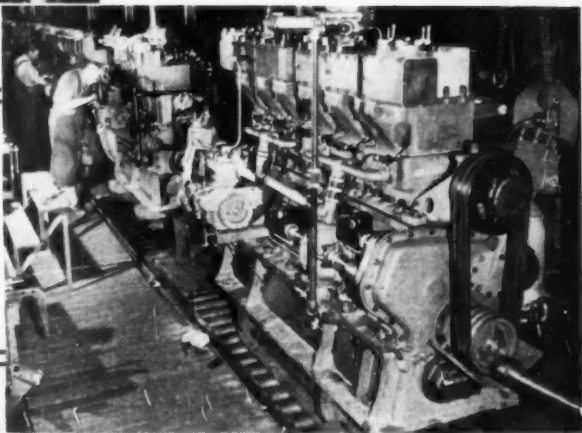
General arrangement of parts and details of the swing type intake valve are shown in this cross section of the Butterworth engine.

Manual Handling Reduced on



One of the innovations at Waukesha is the provision of convenient oil squirt lines along engine assembly lines. They are used to oil pistons and rings, cylinder barrels, rocker arms, connecting rods, bearings, gears, and camshaft line. By piping oil under pressure from a storage tank, the operation is made convenient and easy, provides close control of quantity of oil, and assures cleanliness. Moreover, it eliminates the mess and clutter associated with the use of the usual oil cans.

Major feature of engine assembly at Waukesha is this heavy duty assembly line for building extremely large engines. For example, the one in the foreground is the Model 6-NK, having a displacement of 2894 cu in. weighing about 4½ tons. Engines come off this line ready for power take-off installation and final testing.

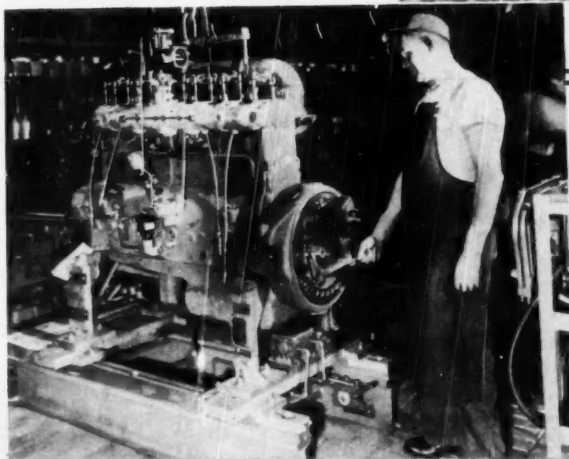
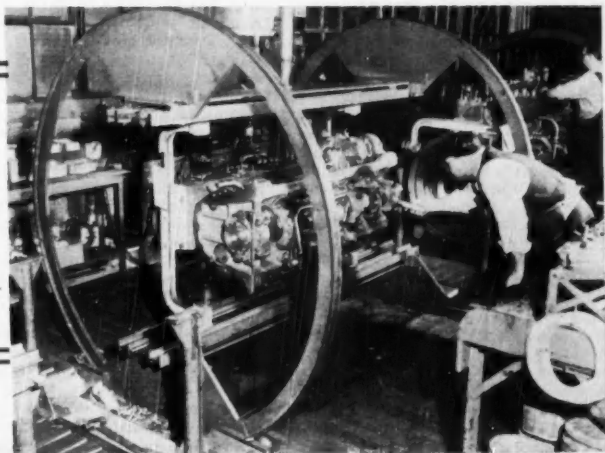


Another of the noteworthy assembly lines is this one for unit powerplant assembly. The gravity roller type assembly line seen here is provided with four turntables. Three of the turntables rotate on fixed centers for convenience in installing radiators, roofs, and power take-offs. The fourth unit, in the foreground, runs on rails for shuttling units from the assembly line into position for test. After testing, the same turntable is used to move the units from the test line onto another section of the roller conveyor which carries them through the paint booths.

Waukesha Engine Assembly Lines

In recent years Waukesha Motor Co., Waukesha, Wisc., has made great strides in the development of integrated machine shop lines designed for straight-line manufacturing. At the same time the numerous engine final assembly lines have been organized for handling engines of various types and sizes in orderly fashion with provisions for simplifying the work of operators as well as reducing manual handling. A sampling of some of the assembly lines, illustrated here, provides a perspective of typical procedures.

Large rollover fixtures are used on assembly lines for big engines to position them conveniently for various assembly operations. The line seen here has seven rollover stations, capable of accommodating engines weighing up to 2 1/4 tons. The assembly line for the largest engines has two motor-driven rollover stations.



Facing and boring of the flywheel housing pilot to assure precise alignment of clutch and transmission assemblies is done after the engine has been completely assembled. This is done on all engines, as shown here. For the operation, the crankshaft is turned slowly by means of a shaft extending from a motor-driven gear box which may be seen at the extreme left. The jig which carries the cutting tool is mounted on the engine flywheel.

LPG

LPG Versus Gasoline and Diesel Fuel

By Eugene S. Corner,
Standard Oil Development Co.

and E. H. Berg,
Esso Standard Oil Co.

THE mileage per gallon obtainable on liquid fuels in internal-combustion engines is controlled—other things being equal—by the Btu content per gallon, and by the compression ratios of the engines in which they are used. Inasmuch as LPG can vary considerably in composition, from essentially pure propane to almost pure butane, the mileage per gallon of LPG consumed will be a function of this variable. In engines of comparable size and compression ratio, propane is indicated on a Btu basis to give only 73 per cent of gasoline mileage. This percentage is increased by adding butane to the propane, until a value of about 81 per cent is reached for 100 per cent butane. However, unpublished work carried out by the Standard Oil Development Co. a number of years ago, as well as data reported in the literature, indicate the Btu utilization efficiency with LPG in actual service to be approximately 10 per cent higher than with gasoline. Accordingly, the best estimate for LPG mileage is that it will range from about 80 to 89 per cent of gasoline mileage in engines of comparable size and compression ratio. Data are given in Table 1. The higher Btu efficiency for LPG results from better mixing, more uniform distribu-

tion to the cylinders, and absence of fuel slugging during sudden accelerations. The intake manifold in an LPG engine should be operated at low temperatures in order to maximize the efficiency. It is believed that statements to the effect that lower-than-predicted mileage has been obtained in some units which operate on LPG are attributable primarily to improper adjustment of the air-fuel ratio.

Relative fuel economy on LPG can be increased appreciably by raising the compression ratio; the influence of this variable is shown graphically in Fig. 1. If engine displacement is reduced or the axle ratio is lowered to provide the same performance on the road when the compression ratio is increased, the improvement in fuel economy follows along the upper curve in Fig. 1; whereas an increase in compression ratio alone results in lesser improvement, as indicated by the lower curve. In the latter case, however, there is an improvement in power which is equal, percentagewise, to the difference between the two curves. In the case of one bus powered by a high compression-ratio LPG engine, the axle ratio can be lowered below that used in the corresponding gasoline bus in order to obtain the maximum fuel economy at

the same performance level. Even though this is not done, there will generally be a greater improvement in fuel economy than indicated by the lower curve in Fig. 1—this resulting from the higher power output and the consequent shortened time in lower gears during acceleration from a stop or under hill-climbing conditions. Moreover, in many cases there will be a credit for

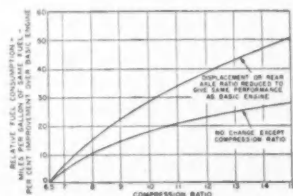


Fig. 1 — Effect of compression ratio on fuel economy.

the shorter trip time made possible by the increased power output. Because of these factors, and because of the relatively low cost of overdrive equipment or of changing the axle ratio, the upper curve in Fig. 1 has been employed for computation purposes.

At the present time 10 to 1 is the highest practical compression ratio for operation on LPG. Fuel mileage on LPG in a 10 to 1 compression-ratio en-

TABLE 1—Fuel Economy of LPG Compared with Gasoline

Same Compression-Ratio Engines

Fuel:	Gasoline	Propane	50 Per Cent Propane 50 Per Cent Butane* (Mol per cent)	100 Per Cent Butane*
Btu per pound†	18,900	19,920	19,755	19,501
Btu per gallon (60 F)	116,000	84,400	89,000	94,200
Relative miles per gallon (per cent):				
Same Btu efficiency	100	73	77	80
10 per cent higher Btu efficiency on LPG	100	80	84	89

*—2-to-1 nbutane-isobutane molar ratio.

†—Heat of combustion at 25 C (77 F); products of combustion in gaseous state; LPG gaseous, gasoline as liquid.

as a Motor Fuel

The use of liquefied petroleum gas (LPG) as a motor fuel highlighted a session of the sixteenth annual mid-year meeting of the American Petroleum Institute's Division of Refining held recently in Tulsa, Okla. Papers presented brought out the advantages, characteristics, sales potential, new markets, and distribution of LPG. Presented herewith are extracts of three papers which were read at the meeting.

gine will be slightly better than gasoline mileage in a conventional 6.5 to 1 compression-ratio engine when propane is the fuel, and will be as much as 15 per cent greater than gasoline mileage when butane is employed.

Two limitations place a restriction on the quantity of butane which can be utilized. First, the knock-limiting compression ratio for n-butane is about 8.3 to 1, and for isobutane it is 11.4 to 1. Accordingly, 100 per cent butane fuel could be employed in a 10 to 1 compression ratio engine only if the isobutane content is high. The knock-limited compression ratio for propane has been stated to be 14.5 to 1. A second disadvantage of LPG fuels of high butane content is their relatively low vapor pressures. It is customary, when LPG is utilized, to make use of the vapor pressure above the liquid in a closed fuel tank so as to force fuel to the carburetor; hence, super-atmospheric vapor pressures must exist under all ambient temperature conditions which are likely to be encountered in over-the-road driving. Inasmuch as n-butane boils at +31 F, and isobutane at +11 F, an appreciable quantity of propane which boils at -44 F must be present in order to provide adequate vapor pressures under cold-weather conditions.

Because of these limitations, as well as of fuel-availability considerations, it appears that predominantly pure propane is the fuel which will be used for automotive applications. Although propane will give at least as high a level of fuel mileage in a 10 to 1 compression-ratio engine as does gasoline in a 6.5 to 1 compression-ratio engine, as mentioned previously, such is not the case in comparison with Diesel fuels. Propane has only 66 per cent as high a Btu content per gallon, and Diesel fuel is employed in a 16 to 1 compression-ratio engine. It is indicated that propane in a 10 to 1 compression-ratio engine will give about 73 per cent of Diesel mileage.

It should be borne in mind, however,

that there is a fuel-economy advantage for propane-butane mixtures; and the use of such mixtures will provide a more favorable comparison of LPG

with gasoline and Diesel fuels, assuming no premium price for propane-butane mixtures relative to the price of propane.

LPG Development

By R. C. Alden, Forrest E. Gilmore, and Paul W. Tucker
Phillips Petroleum Co.

THE fastest growing market in recent years for LPG is as a motor fuel, as is portrayed in Fig. 2. Of all the markets, this is the only one which is growing at a faster rate than the total sales.

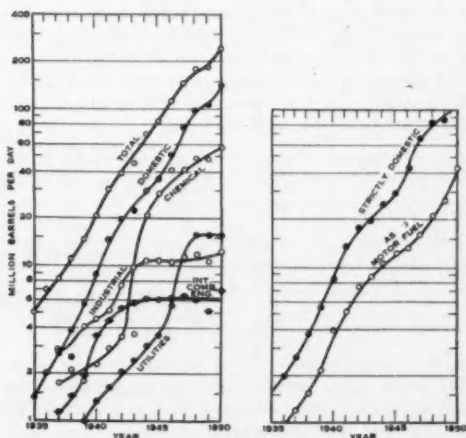
It is believed that only the motor-fuel market for LPG is large enough to provide an outlet for the very large new quantities of LPG which will be available for sale if past rates of growth in total sales are maintained in the future. If this new market is not captured by LPG, there is every indi-

cation that the rate of growth of LPG sales will decrease. However, judging by past history, any new market incentives, such as the current trend toward power uses, can greatly accelerate new production of LPG within the limits of transportation and marketing facilities to keep pace with it.

War Considerations

The total production of the four refinery fuels follows a rather consistent (Turn to page 98, please)

Fig. 2 — These two graphs show the marketed production of LPG. The first chart illustrates the various uses based on data from the U. S. Bureau of Mines, while the second chart is a revision of domestic and motor fuel uses of LPG.





Edward Whitney Miller, president, Fellows Gear Shaper Co., was the 1951 recipient of the Connell Award.

Gear Makers Meeting and

By Thomas

to the gearing industry and for the election of officers. The well attended affair, held in Hot Springs, Va., June 4, 5, and 6, was highlighted by numerous technical and commercial committee meetings as well as three general sessions. A great deal of interest was shown by the many members present at the sessions and there was much spirited discussion.

A feature was the presentation of the Connell Award at the Annual Dinner. This award was established by the Falk Corp. in commemoration of the late Edward P. Connell, a vice president of the firm. It was given to Edward Whitney Miller in recognition of the leadership he has displayed over the last 35 years in the development of sound principles in gear engineering. Mr. Miller, current president of the Fellows Gear Shaper Co., is a past president of the AGMA.

During the course of the three-day meeting, LeRoy

TO top off another highly successful year in the annals of the American Gear Manufacturers Association, the organization held its Thirty-fifth Annual Meeting for the discussion of subjects relative

Powder Metallurgy for Gear Manufacture

By D. W. Lynch, T. J. Snodgrass, and T. T. Woodson

General Electric Co.

POWDER metal gears are subject to certain dimensional manufacturing errors. The first three listed below are common to both conventional gears and sintered gears, although they arise from different sources. The last four listed are unique in powder metal gears due to the process.

Error	Usual Causes
Pitch diameter not concentric	Play in molding tools due to wear
Pitch diameter too large	Die barrel worn
Tooth chordal distance too large	Die barrel worn
Tooth face taper	Die barrel wear always greater at the top than at the bottom
Pitch diameter not round (pear shaped) etc.	Uneven shrinkage due to unsymmetrical blank
Tooth-tooth spacing uneven	Uneven shrinkage, different powder densities, incorrect powder feed into mold
Tooth face not parallel to bore	All reasons given above

Of course, the gears all reflect errors in improperly made tools, whether strictly profile errors or just excessive play between barrel and stripper or stripper and pin. Conversely, all the gears are uni-

form when made from good tools coupled with good molding and sintered practice.

A further comparison is shown in Table I where the typical errors and tolerances of two conventional types of manufacture are compared to those of the powder metal process, stamping, and extruding.

The use of molding or briquetting tools limits the variety of shapes possible in powder metal gears. Of course, subsequent machining or deforming operations are possible, but generally powder metal gears are made in "single draw" tools only (single pressure axis—no re-entrant surfaces). Face notches or interruptions can be molded in if they are not major masses. Of course, the maximum advantage occurs when a gear has a non-symmetrical outline. Here the cost is usually $\frac{1}{2}$ or $\frac{1}{3}$ that of a cast or cut gear.

The tooth shape depends on the method of tool production. Customarily a set of broaches are prepared by form-grinding the teeth, in a "milling machine" set up so undercut is not possible. These

Hold Annual Elect Officers

MacNew

R. Brooks, Jr., 1950 president of the society, announced the resignation of Newbold C. Goin, executive secretary of the AGMA. Mr. Brooks expressed deepest regrets on behalf of the AGMA at the leaving of Mr. Goin who has served the society so industriously over a period of years.

Officers elected for 1951 were as follows: president, George H. McBride, manager of the Gearing Div., Westinghouse Electric Corp.; vice president, S. L. Crawshaw, assistant to the president, Western Gear Works; and treasurer, Louis B. Bond, vice president and general manager, Christiana Machine Co. Their term of office is for one year and begins this month.

Four members were elected to the AGMA Executive Committee and they will serve until June 30, 1954. They are R. B. Holmes, general manager, Philadelphia Works, Link-Belt Co.; Charles R. Kessler, president Beaver Gear Works, Inc.; Gunnar E. Gunderson, presi-



Newly elected president of the AGMA is George H. McBride, manager, Gearing Div., Westinghouse Electric Co.

dent, Brad-Foote Gear Works Inc.; and Marvin R. Anderson, executive vice president, Michigan Tool Co.

Extracts of the two technical papers presented at the three-day conference are given herewith.

Table I—Limiting Tolerances for Different Gear Manufacturing Processes

Process	Degree* of Care	Tooth to Tooth Spacing	Concen- tricity Full Indicator	Profile Inv. Var.	Helix	Composite Check Total Tooth Error	Tooth Thick- ness	Tooth Surface Finish rms Microinches
Sintering—Assumed size of part: 0-1½" diam., 0-¾" face width, 10 to 32 diam. pitch								
Commercial	0.0007	0.0025	0.0005	0.0007	0.003	0.001	45	
Sintering—Assumed size of part: 1½" to 4" diam., 0 to 1" face width, 10 to 20 diam. pitch								
Commercial	0.001	0.004	0.001	0.0007	0.004	0.002	45	
Stamping—Assumed size of part: 0 to 1" diam., 0 to ⅝" face width, 20 to 128 diam. pitch								
Commercial	0.001	0.003	0.001	0.0005	0.004	0.001	128	
Extruding—Assumed size of part: 0 to ½" diam., 0 to ¼" face width, 20 to 128 diam. pitch								
Commercial	0.001	0.005	0.002	0.001	0.007	0.001	64	
Hobbing—Assumed size of part: 0 to 6" diam., 0 to 1" face width, 20 to 128 diam. pitch								
Commercial	0.0005	0.003	0.001	0.001	0.0035	0.002	63	
Precision	0.0003	0.002	0.0006	0.0005	0.0025	0.001	32	
Very best	0.0002	0.001	0.0004	0.0003	0.0012	0.0005	16	
Grinding—Assumed size of part: 0 to 8" diam., 0 to 1" face width, 8 to 64 diam. pitch								
Commercial	0.0005	0.002	0.0010	0.0005	0.0025	0.0015	40	
Precision	0.0003	0.0012	0.0004	0.0003	0.0015	0.001	25	
Very best	0.0002	0.0006	0.0003	0.0001	0.0010	0.0003	10	

* Commercial—Quality obtainable in good job shops.

Precision—Quality obtainable with new or first class machine tools and precision tooling.

Very best—Quality at 25 to 50% extra cost. Best tools and personnel.

Gear Makers Hold Annual Meeting

broaches cut the die-barrel. A "stripper" similar to a broach is ground for forming the ejecting floor of the cavity. Ordinarily the broaches are kept on hand for making future die-barrels.

The tooth root is made a pure radius by some tool vendors because of the fragility of the wheel and general difficulty when grinding a conventional three-radius root. Otherwise, the tooth (flanks and O.D.) are supplied in conventional form.

Range of sizes manufacturable depends on the strength of the tools (punches) in the small sizes and the capacity of the presses in the large sizes. High strength gears (85,000 psi) from 3/16 in. diam up to 3 1/2 in. diam have been made, the latter using a 300 ton press to briquette the green part. Of course, web perforations would allow the same area to be enlarged to a greater pitch diameter. In the medium and larger sizes about 30 tons per sq in. exposed area are required for briquetting. The thickness of the blank (tooth face) is comparatively un-

important as far as molding goes; it counts mainly when warpage may distort the tooth flank and prevent adequate uniformity of contact. In addition thin blanks (less than 3/32 in.) are difficult to strip from the mold without injury to teeth, and excessively heavy sections may have low density because of briquetting pressure loss from excessive wall friction. The diametral pitches have varied from 32 to 10.

Teeth can be molded in the hub of a dual gear with optimum strength obtained by blending the flanks and root with the hub for minimum stress concentration. No other method of making accurate metal gears can yield such geometry. Simple gears can be made with helical teeth molded in. Of course, splines, key ways, and double-D bores can be molded in when the concentricity tolerance of about 0.005 in. t.i.r. can be accepted. Round bores are frequently bored or ground with respect to the pitch-line, in a pin-chuck, for optimum concentricity after sintering.

Design Considerations for Plastic Gears

By Fred R. Zumstein,
Fellows Gear Shaper Co.

DESIGN considerations are of prime importance where new materials are concerned and have rightful origin on a drawing board and the model room. A completed design assembly can then weather the scrutiny of the sharp-pencilled cost estimator without consequent production pitfalls because of inadequate coring, thin wall sections, sharp corners, etc.

In the less rigid thermoplastic gears, such as nylon, we have resiliency which absorbs the inevitable inaccuracies of cut gears. The self-lubricating characteristics which is made use of in plain nylon bearings finds favorable application in offsetting friction of mating gear tooth surfaces.

The Massachusetts Institute of Technology has conducted a series of tests on non-metallic gears and has worked out a velocity factor in recognition of the low specific gravity of such materials as nylon and laminated phenolic gears. This specific gravity is less than one-seventh that of steel which results in low centrifugal stresses. This Massachusetts Institute of Technology velocity factor for non-metallic materials equals

$$\frac{150}{200 + \text{p.l.v.}} + 0.25$$
 whereas the velocity factor for metallic gears is usually considered to be $\frac{600}{600 + \text{p.l.v.}}$ (p.l.v. is pitch line velocity.) Consequently, with pitch line velocities greater than 1000 fpm, the velocity factor will be more than that which would result using the formula for metallic gears.

A safe working stress is the product of the static stress and the velocity factor. In the case of nylon, du Pont advises that this material has a tensile strength at room temperature of 10,530 psi. They

have further qualified as a result of flexural fatigue tests for nylon FM-10001, a value of 6000 psi.

The following table notes safe working stresses at varying pitch line velocities using the above formula for non-metallic materials and the conservative 6000 psi as a static stress factor for nylon:

P.L.V. Feet Per Min.	Nylon FM-10001*	P.L.V. Feet Per Min.	Nylon FM- 10001*
100	4500	1000	2250
150	4071	1500	2029
200	3750	2000	1909
250	3500	2500	1833
400	3000	3000	1781
500	2786	4000	1715
800	2400		

* Safe Working Stress.

Theoretically, plastic and steel gears deflect similar amounts when subjected to loads proportional to their moduli of elasticity. We can determine horsepower loads based on the strength of a single tooth using the safe working stress factor for plastic. Rigid metal gears with slight inaccuracies of tooth form and spacing may create high dynamic loads which have to be carried by a single tooth. The resiliency of nylon plastic, however, may allow under load conditions, contact of two or more teeth. Consequently, computations will be conservative.

Tooth wear on plastic gears is effected by relative sliding of gear tooth surfaces, excessive compressive stress at progressive points of contact, and cutting the flank of the driving tooth by the tip of the entering tooth. In the case of a nylon driving pinion mated with a steel gear, it is relieved of this undue wear by using the all-addendum form on the pinion thus re-

(Turn to page 108, please)

Checking V-8 Crankshaft by Air Gaging Machine

AMONG the many interesting and unusual quality control devices used for inspecting components of the Chrysler V-8 engine is the air gaging machine illustrated here for simultaneous checking of a large number of critical dimensions of the crankshaft. The individual Airsnap gaging head which is connected to the four-column Precisionaire gage at the right is used for checking the 2.249-2.250 in. diameter of crank pins at three points for size, taper, hourglass, and out-of-round. High fillets of pins as well as thrust bearing width are checked at the same time.

In operation the crankshafts are delivered to the inspection machine on the conveyor seen here, removed from the conveyor and placed into temporary precision ball-bearing locators near the flange end and a "U"-trough at the pilot end. The crankshaft then is lowered into the gaging station by means of an air-cylinder-operated slide. All gaging surfaces are lined with cemented-tungsten-carbide.

Simultaneous readings are indicated on the large panel mounted at the top of the machine. Measurement of diameters is indicated by the position of the float between fixed markers in the respective tubes. Eccentricity and runout, on the other hand, are indicated by variations in float height when the shaft is rotated.

Some impression of the amount of information made available by this direct-reading, visible tube instrument may be gained from a listing of the variety of gaged elements as follows:

1. Five main bearing journals (2.4995-2.5005 in diameter) checked at three points for size, taper, hourglass, and roundness.
2. Sprocket diameter — 1.563-1.564 in.
3. Flange diameter — 4.8115-4.8125 in.
4. Vibration damper diameter—1.530-1.531 in.
5. Radial runout of flange OD within 0.002 in.
6. Lateral runout of flange face within 0.001 in.
7. Runout of thrust bearing.
8. High fillets on each main bearing journal.
9. Radial location of keyway to No. 1 pin.
10. Lateral location of each of four crank pins.

To this list must be added the auxiliary gaging unit for checking the four crank pins and high fillets.



This is a view of the temporary setup of the crankshaft gaging machine, the supplementary gaging station being shown at the right.

By
Joseph
Geschelin

Making Jet Engine

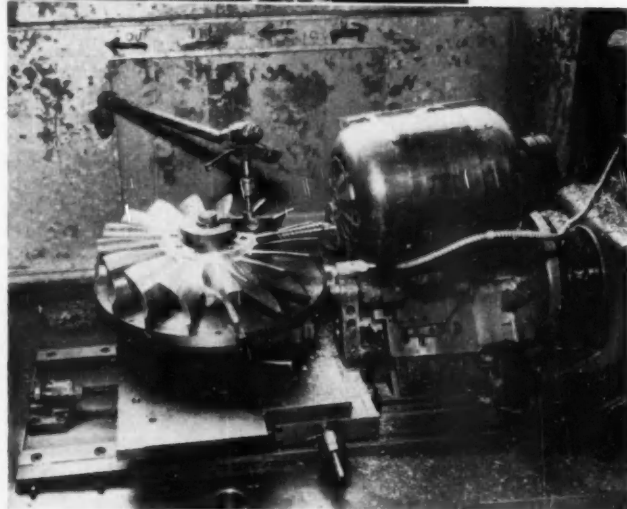


INDUCERS—rotating guide vanes—for Allison J33-A-31 and -33 jet engine impellers produced by Thompson Products, Inc., in its Tapco plant represent some of the most advanced refinements of manufacturing methods and equipment.

From this standpoint an appraisal of current production methods should be of general interest and value.

Consisting of front and rear sections of similar design, the inducers start as vane forgings of aluminum alloy, weighing about 50 lb each. By the time the multiplicity of metal removal stages has been completed, the weight of the finished part has been reduced to around 25 lb. Chip removal of this order, particularly when it must take place in many controlled stages, sometimes with relatively light cuts, accounts for the time, labor, and cost involved in producing highly stressed aircraft engine components.

In view of the complexity of machining and polishing operations, this article will account for only a sampling of the complete process. In following the sequence of operations, it will be noted that the work is subjected to a series of roughing operations, then the special milling operations



Here is the setup for hollow milling of vanes. Note the huge hollow mill with its cemented-carbide blades.

One of the DeVlieg special mills for finish-milling the front and back sides of blades—in separate settings. Features of this machine are its specially designed tool head and long tapered milling cutter. The head is cammed to generate the required contour.

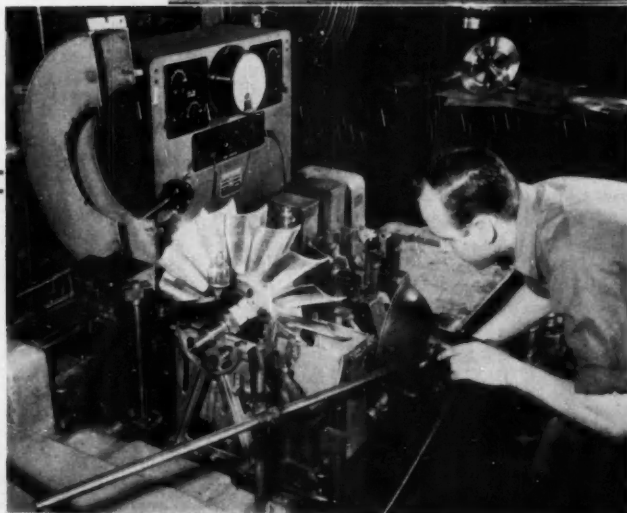
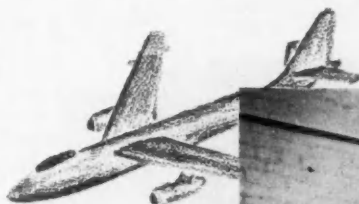
Inducers an Exacting Process

on the vanes in DeVlieg mills. Hollow-milling of vanes is illustrated here to emphasize the design of the large-diameter hollow mill with its cemented-carbide blades.

Another of the illustrations shows the method of milling the curved blade surfaces, the front and back sides being handled separately but in similar fashion. For this operation a long, tapered milling cutter is employed, arranged on a tool head which describes a suitable patch controlled by cam action.

At the completion of the preliminary stages, which account for a good portion of metal removal, the work is given a heat treatment. The hub is then precision-bored and the part made ready for a high speed spin test. For this purpose the inducer is mounted on a special arbor and checked for dynamic balance as an assembly in a Gisholt Dynetric balancer. Since the inducer itself is not required to be in balance at this stage, adjustment for balance is obtained by adjusting screws in the arbor. The spin test is done in a special pit-type machine in which the work is rotated at 14,100 rpm, with the arbor mounted vertically.

Upon completion of the spin test the work returns to the
(Turn to page 96, please)



Top

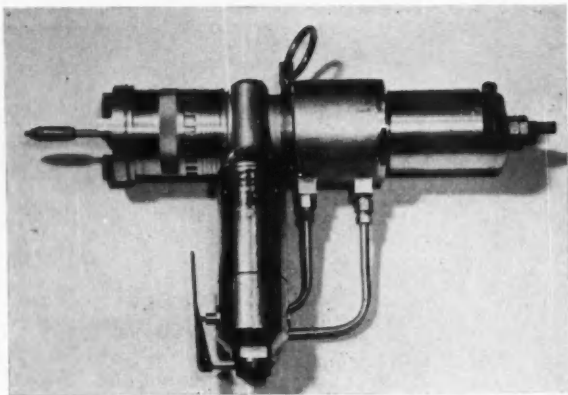
An air turbine rotates the inducer at 14,100 rpm for its overspeeding test. Before testing is started, the equipment shown here is lowered so that the inducer is within a pit sunk below floor level.

Right

Gisholt Dynetric balancing machine, one of two units, used for dynamic balance of the partly finished inducer prior to high speed spinning and later for dynamic balance of the finished part to a tolerance of 0.050 oz in.

Portable Countersink Tool Developed at Boeing

The Auto-Sink, a portable air driven tool for countersinking holes in heavy gage sheet metal.



A NEW device, known as the Auto-Sink, for countersinking holes in heavy gage sheet metal, developed at Boeing Airplane Co., Wichita, Div., is said to reduce by 80 per cent the time ordinarily required for this type of work.

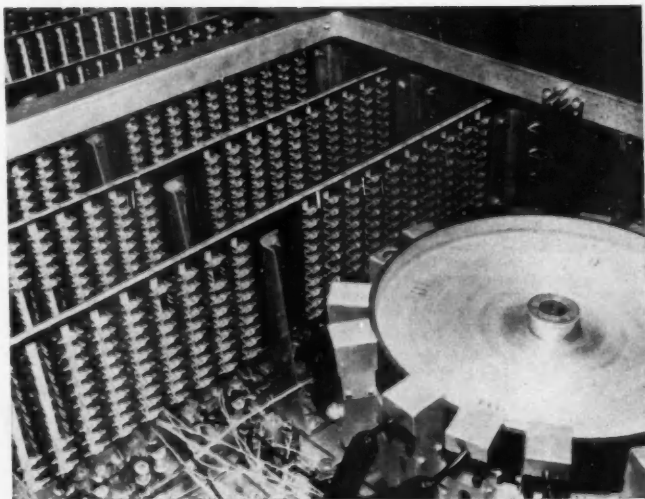
The portable, air-driven tool was designed primarily for use in the Boeing B-47 Stratojet bomber production program. Some 15,000 close-tolerance holes must be countersunk in the 75ST aluminum wing of a single B-47. Before adoption of the Auto-Sink approximately $3\frac{1}{2}$ min were required to countersink a $\frac{1}{2}$ -in. diam hole in a 75ST aluminum alloy sheet. In addition, the workman had to expend a large amount of energy, forcing the tool against the work sur-

(Turn to page 92, please)

Compact Electronic Computer for Engineering Data

NORTHROP Aircraft, Inc., has developed a new type of electronic computer that is smaller than an average office desk, yet its mathematical capacity places it in a class with some of the extremely large computers used by a few universities. The machine is known as Maddida, a coined word developed from the full descriptive name "magnetic drum digital differential analyzer." It employs less than 100 vacuum tubes and has only one prin-

(Turn to page 92, please)



Hundreds of germanium diodes, as shown, are used in the electronic computer. In the right foreground is the magnetic drum which can store about 10,000 digits.

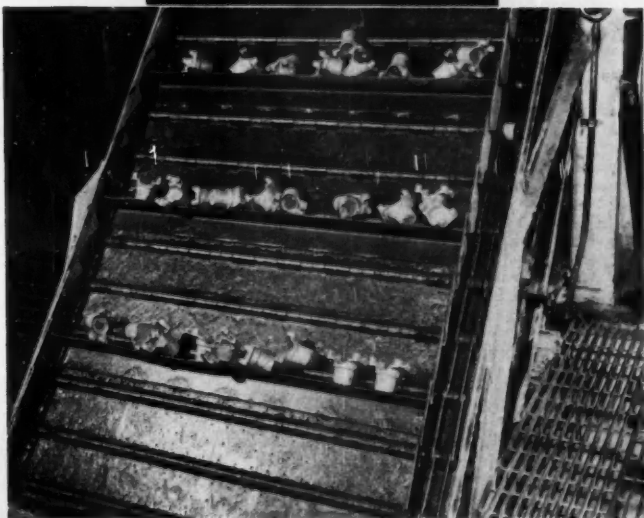
New Chemical Bath "Blasts" Scale from Forgings

Transferring universal joint forgings from container to heat treat furnace where parts are held at 1560 F for 10 minutes. Heat treated work drops directly into the water quench tank and onto conveyor belt. Quench blasts scale from steel surface.



→
A RECENTLY-DEVELOPED new product of the Pennsylvania Salt Mfg. Co., Philadelphia, Pa.—Pennsalt SR-4—has been adopted by the Spicer Manufacturing Division of the Dana Corp. for several of its production operations to remove scale from forgings.

Heat treating of a universal joint component is a typical example of the scale-removal process. A bath is made up of Pennsalt SR-4 dissolved in weak hydrochloric acid and water, and parts covered with forging scale are immersed in the bath for five minutes. The universal joint forgings are then removed from the solution, heated to a temperature of 1560 F., and held at this temperature for 10 minutes. Following heating, the forgings are water-quenched. Due to the action of SR-4 with which the forgings were treated, scale actually blasts from all surfaces, leaving them clean for subsequent machining.



→
Forgings are shown being carried from the water quench to the tempering furnace. Note effectiveness of scale removal after quenching of these SR-4 treated parts.

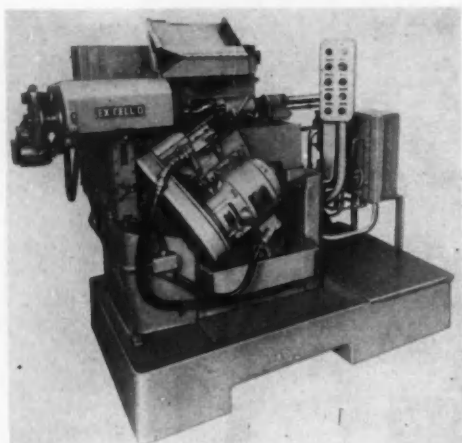


• PRODUCTION • EQUIPMENT • PLANT •

NEW NEW



FOR ADDITIONAL INFORMATION regarding any of these items, please use coupon on PAGE 64



Ex-Cell-O machine for milling airfoil form on jet aircraft compressor blades

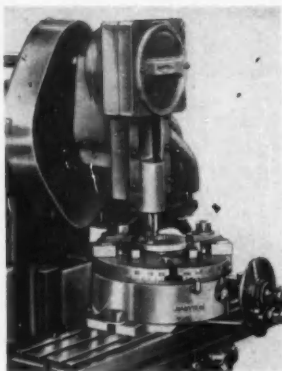
E-1—Miller for Jet Compressor Blades

Ex-Cell-O Corp., Detroit, Mich., comes out with a standard machine for milling the airfoil form on jet aircraft compressor blades, the machining cycle of which is completely automatic except for loading the work, pressing the start of button and unloading the work at the end of the cycle. Blades are located from the finished root form (as ground on the Style 85 Ex-Cell-O two wheel form grinder) at one end and from a center in the other end. Accuracy of airfoil form is assured by use of master cams made directly from the engineer's glass layouts. The coolant equipment also has automatic controls.

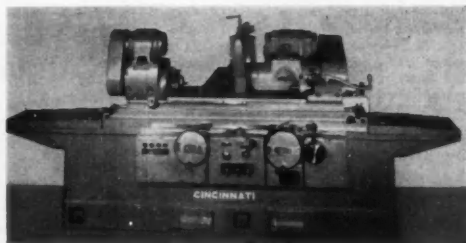
The Ex-Cell-O Style 86 precision profile miller mills the complete airfoil form including leading and trailing edges. A feature is the rigid support of work by back rests throughout the cutting stroke. Cutting pressure cannot distort the blade. When the start button is pressed the headstock, tailstock and back rests are clamped hydraulically. The work moves lengthwise across the cutter at an adjustable rate of feed, and at the end of every cutting stroke the headstock, tailstock and back rests are unclamped and the work is indexed. The amount of movement during indexing and the total number of indexes are determined by

the positioning of pins in an index plate. After the last cut the machine comes to rest with the work raised from the cutter, and the headstock, tailstock and back rests unclamped.

E-2—Machine Slotting Attachment



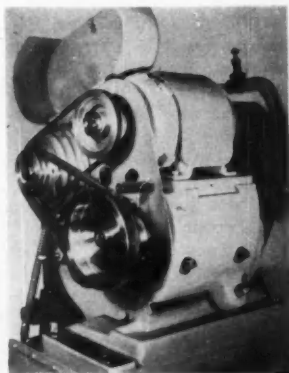
Slotting attachment introduced by Marvin Machine Products, Inc., Detroit, Mich., possesses positive drive regardless of rate of speed, roller chain to eliminate slippage and allow heavy cuts, and safety hood over transmission to protect operator.



Cincinnati center-type plain hydraulic grinding machine.

E-3—Improved Hydraulic Grinding Machine

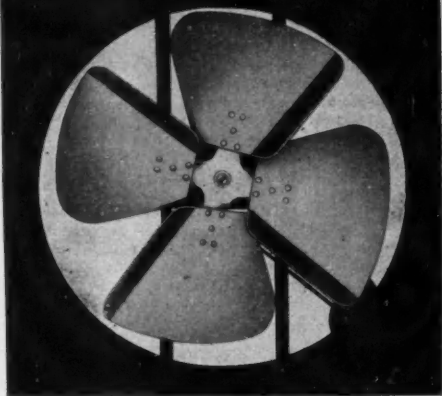
Completely redesigned headstock of the 10 in. and 14 in.-L plain hydraulic grinding machines put out by Cincinnati Grinders, Inc., Cincinnati, Ohio, is



Redesigned headstock of Cincinnati grinder, with belt guard open.

now powered by a one hp AC motor, eliminating necessity of a DC line to the machine. A magnetic brake is built-in. Power is transmitted entirely through V-belts. An eccentric arrangement for the primary countershaft provides a way to adjust belt tension and change the belt on the four step pulley.

The bed is 2 in. lower than before, now only 39½ in. from the floor line to the centers. Grinding wheel collets are designed for 12 in. hole wheels, for continued usefulness on smaller machines after the OD wears beyond the



SCHWITZER-CUMMINS FRESH-AIR MAKER FANS *Keep You Cool*

SUMMER'S HEAT KNOCKS PRODUCTION

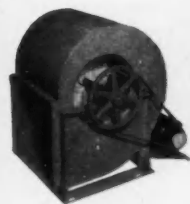
THE LOW COST OF COOLING AND VENTILATING HOT
SPOTS IN PLANT OR OFFICE WITH FRESH-AIR MAKERS

will surprise you!



Twelve sizes of FRESH-AIR MAKER industrial fans for any job, large or small, up to 20,500 cfm for a single fan. Unusually adaptable for wall, loft, monitor or penthouse installations or in the ceiling as they are equipped with ball bearings to permit horizontal installations if desired.

A 200 cfm, 24", out-side, costless installation, weather proof—Available in guarded cabinet for floor circulator.



Blowers, silent low pressure units, single inlet, double inlet, 300 cfm to 15,000.



Adjustable, Reversible, Two Speed window fans—three sizes, ideal to balance and distribute air in a many windowed office.



Over main entrance to reception room.



Horizontal Attic Fan—two speeds—specialty—flat ceiling installation. Ball bearing fan and motor.

Conditioner in roofs and walls, uncomfortable "shops" and annexes.



FRESH-AIR MAKER Portable—Life savers for hot offices—Directs air up, down, under desk, into corners—completely portable.



Non-ferrous Foundry—3-48" Fresh-Air Makers (61,500 cfm) in roof.

OUR OWN PLANTS COOLED
AND VENTILATED WITH
FRESH-AIR MAKERS—A
WONDERFUL ADDITION TO
GOOD WORKING CONDITIONS



Selectively placed for overall ventilation and cooling large machine dept.

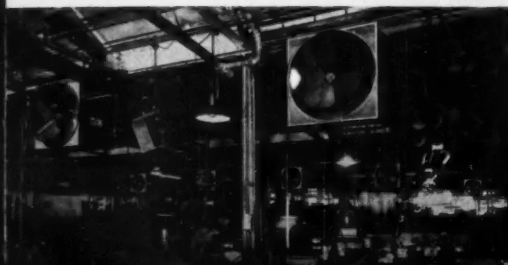
For Further Information just WRITE, CALL OR WIRE

SCHWITZER-CUMMINS COMPANY

VENTILATING DIVISION

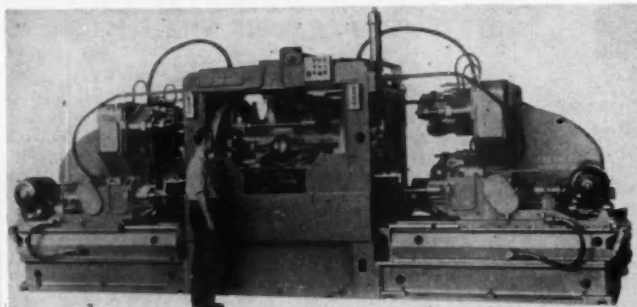
INDIANAPOLIS 7, INDIANA

*Builders of
Fine Fans and Blowers for Over 30 Years*



For additional information regarding any of these items, please use coupon on page 64

E-4—Four-Way Automatic Indexing Machine



Four-way horizontal and angular six-station automatic indexing machine built by Greenlee Bros. & Co., Rockford, Ill., for machining automobile rear axle housings, completes thirty operations on the housings in 29.2 seconds for an hourly production of 123 pieces.

Two diameters are combination-bored in each end of the housings, and the ends

faced at station two. Semi-finish boring operations on the two diameters are completed in the third station. Stations four, five, and six drill, chamfer, and ream four holes in each of the housing end-flanges respectively.

Two rear heads at stations five and six drill and tap the breather hole in the side of each housing.

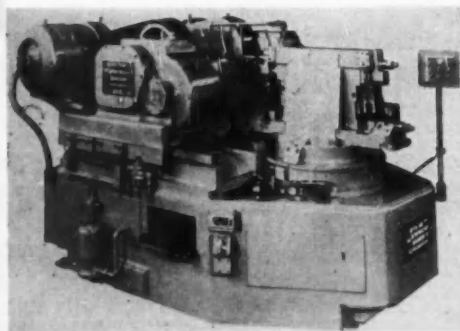
size for efficient grinding. The Filmatic bearings for the grinding wheel spindle have been retained. These are self-adjusting for every grinding condition.

E-5—Two-Station Milling Machine

The Motch & Merryweather Machinery Co., Cleveland, Ohio, is putting out a duplex milling two-station machine for face milling. The work illustrated

is machining of tractor side bars mounted two in each station. Production is rated at 268 pieces per hr, using carbide tipped cutters. A rotary indexing table carries two sets of work-holding fixtures. While the two milling heads are machining the part held at the work point, the operator is unloading and loading the open fixture. The cycle of operation is automatic when the operator presses the cycle button.

The table carrying the fixtures and work indexes 180 deg and is clamped



Motch & Merryweather duplex milling machine, No. M-15 HDH.

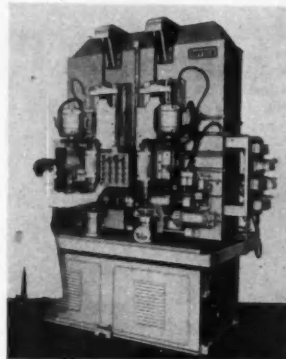
solidly into position. The two opposed milling heads traverse forward, feed to an adjustable stop and rapid traverse return. The heavy duty milling heads can utilize up to 30 hp and have two in. of quill adjustment for cutter wear. Carbide or high speed steel cutters can be used.

Milling heads are of the single-speed type. Speed changes can be made, however, by pick-off gears easily accessible. Movement of the milling heads and indexing of the table are hydraulic. Lubrication of all moving parts is automatic.

E-6—Automatic Duplex Machine

Snyder Tool & Engineering Co., Detroit, Mich., have recently built an automatic duplex machine to precision bore and face end shields for fractional hp electric motors.

Operation consists of finish turning and facing the rabbet on the O.D. of the aluminum body and finish boring



Snyder automatic duplex machine.

the I.D. of the hub bushing which may be either steel or babbitt. Production ranges from 210 pieces to 338 pieces per hr at 75 per cent efficiency, depending upon size of part, length of feed, and material cut.

Power is supplied by two one hp, 600 rpm chuck motors and two ¾ hp, 1800/900 rpm spindle motors. Spindles are driven through "Vee" belts which allow variation in the spindle speeds. Present spindle speed is 4778 rpm and chuck speed is 334 rpm.

Clamping is automatic by means of a spring diaphragm. Unclamping is accomplished by hydraulic return of the diaphragm.

The duplex cycle consists of unloading and reloading one station while the other station works. Work cycle using tungsten carbide tools is rapid advance, feed, and rapid return of the cross slide to machine the rabbet with chuck revolving, then feed and rapid return

(Turn to page 68, please)

STERLING

PISTONS



*Contributing to Better
Engine Performance
for Over 30 Years*

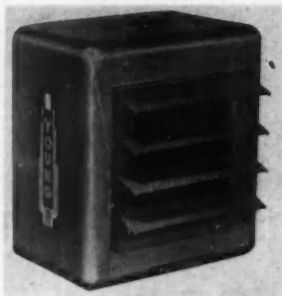
Sterling Engineers will work with you
as they have with other leading
manufacturers in developing pistons to meet
your exacting requirements. Write or phone.



NEW PRODUCTS

FOR ADDITIONAL INFORMATION regarding any of these items, please use coupon on PAGE 64

F-1—Unit Oil Cooler For Heater Equipment



Young unit oil cooler, offered in nine models.

Young Radiator Co. of Racine, Wis., and Mattoon, Ill., are placing on the market nine models of unit oil coolers for warming interiors where water is at a premium and/or waste heat can be recovered.

Compact with attractive gray metallic casing, the models provide non-ferrous tube-and-fin construction, for use with oil pressures up to 150 lbs. The cooling element is supported in the casing by special spring suspension to eliminate damage from expansion and contraction. The casing is of welded steel construction for ruggedness and freedom from objectionable vibration and noise.

The Young agitator is said to increase heat transfer 100 per cent by breaking up the flow in such a manner that the oil is constantly wiping the tube surface for maximum heat transfer.

F-2—New Grinding Wheel Bond

Designed especially for tungsten carbide tool sharpening, a new grinding wheel bond developed by Chicago Wheel & Mfg. Co., Chicago, Ill., shows promising time and cost economies in a field threatened with material and labor shortages. The bond—XL—is claimed to make vitrified silicon carbide grinding wheels "the closest we know to diamond wheels," states the company.

XL bonded wheels are recommended

for offhand or precision grinding of carbide tools on milling cutters, broaches, reamers, counter bores, etc. They are stated to provide cutting action that is both cooler and faster than conventional silicon carbides in comparison tests.



Chicago Wheel & Mfg. Co. grinding wheel bond called XL, incorporated in wheels for carbide tool sharpening.

The wheels are being supplied in the most popular straight and cup wheel sizes and steel backs.

F-3—Catalyst for Synthetic Rubber

A new chemical development will substantially increase synthetic rubber production from the same amount of raw material now used, according to the Dow Chemical Co., Midland, Mich.

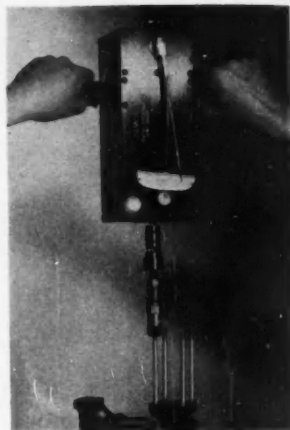
The product is a new catalyst, a calcium-nickel phosphate. It is said to convert approximately 92 percent of butylene into butadiene as compared with about 70 percent conversion for catalysts now in use, when proper adaptations of equipment are made. Conversion of equipment for the product's use is stated to be relatively simple and inexpensive.

The catalyst dehydrogenates n-Butylenes to produce 1,3-Butadiene required for synthetic rubber. With the new catalyst, less gases having only fuel value are produced.

F-4—Torque-Indicating Driver

The new Garvin Torque-Indicating Driver, made by Tru-Circle Products Co., South Bend, Ind., automatically measures the torque as it drives studs, nuts, screws or fasteners. It is declared to give a precise torque measurement not possible with clutch-type arrangements. It is said to eliminate stud breakage and drastically reduce scrap loss, as well as to eliminate wasting man-power on expensive hand-torque-inspections.

The motor is suspended between two ball bearings and connected by bevel gearing to the standard deflection type torque wrench. Minimum torque is indicated by the wrench and by a green light; maximum torque by the same



Garvin torque-indicating driver, offered by Tru-Circle Products Co.

wrench and by a red light. As torque is applied, the motor unit swivels, making contact with micro switches which actuate relays and turn on the lights.

The unit can be furnished with a relay that interrupts the power source and automatically stops the rotation when the desired maximum torque is reached. Adjustments for both high and low torque limits are quickly made by two screws using the torque wrench as an accurate gage.

(Turn to page 70, please)

**Speaking of Preference... 21 of 25
Leading Engine Manufacturers Using Chrome
Rings Specify PERFECT CIRCLES**



**Perfect
Circle**

***The Standard of
Comparison***

The application of solid chrome plating to piston rings, perfected by Perfect Circle, more than doubles the life of pistons, rings and cylinders. Performance data will be furnished upon request.

Perfect Circle Corporation • Hagerstown, Indiana

Publications

AVAILABLE

New Industrial Literature listed in this department is obtainable by subscribers through the Editorial Department of AUTOMOTIVE INDUSTRIES. In making requests please be sure to give the NUMBER of the item concerning the publication desired, your name and address, company connection and title.

D-1 Axles and Transfer Cases

Timken-Detroit Axle Co.—Now available is a 28-page booklet that describes new improvements that has been designed into running gear for military vehicles.

D-2 Friction Materials

Raybestos-Manhattan, Inc.—Just issued is Engineering Bulletin No. 400 featuring brake linings, brake blocks and friction materials in special shapes. The bulletin describes and gives specifications on 50 of the most popular types of brake linings and brake blocks, 22 different clutch facing materials and illustrates various materials in special shapes and sizes which have been produced.

D-3 Cutting Oils

The Texas Co.—Volume 37, Number 7 of the publication "Lubrication" contains 10 pages on transparent cutting oils. The types of oils and their applications are given.

D-4 Optical Positioning Equipment

F. T. Griswold Manufacturing Co.—A 12 page illustrated catalog, 10, just off the press shows how positioning and linear measurement in machining operations and inspection can be performed by the use of the OPL dividing head, a new indexing table and the Scan-A-Scale.

D-5 Forging

Hill Acme Co.—A series of illustrated technical articles on the uses of the modern forging machine, together with the latest developments in hot upset forging practices are now available.

D-6 Diaphragms

Vulcan Rubber Products, Inc.—A new illustrated brochure has just been released which gives detailed proper-

ties and designs of a wide range of synthetic coated diaphragms.

D-7 Fasteners

Shakeproof, Inc., Div. Illinois Tool Works—A new 24-page booklet entitled "Assembly Suggestions" is being offered. The booklet contains details and illustrations of the newest fastening developments.

D-8 Coatings

Casey & Case Coating Co.—Characteristics, properties, uses and methods of application of synthetic rubber resin based coatings is contained in a new brochure just issued.

D-9 Aluminum

Reynolds Metals Co.—A 48-page book, #4460, contains details on the aluminum production facilities, products, fields served and other information designed to give a clear picture of the company and its operations.

D-10 Bus Ducts

Westinghouse Electric Corp.—A new 68-page manual describes types of bus ducts and accessories available, and presents application and test data, specifications, information on pricing a typical bus duct installation, and a typical bill of materials. Request must be made on your company's letterhead.

(Turn to page 100, please)



THIS TIME SAVER COUPON is for your convenience in obtaining, WITHOUT OBLIGATION, more information on any one or more of the publications described above OR New Production and Plant Equipment OR New Products items described on other pages.

Readers' Service Department,
Automotive Industries,
Chestnut & 56th Sts., Philadelphia 39, Pa.

<p>Please send me: These FREE Publications (Use letter and designating number of each item desired)</p> <p>.....</p> <p>.....</p>	<p>Please send me more information on: New Production and Plant Equipment (Use letter and designating number of each item desired)</p> <p>.....</p> <p>.....</p>	<p>Please send me more information on: New Products (Use letter and designating number of each item desired)</p> <p>.....</p> <p>.....</p>
--	---	---

Your Name Your Title

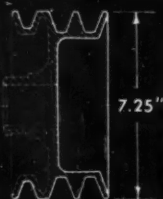
Your Company Connection or Business

Address
(Street & No.) (City) (Zone) (State)

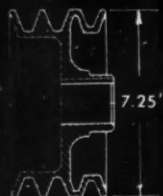
P&J AUTOMATICS

TURN OUT

BETTER WORK...
AND MORE OF IT...
WITH FEWER REJECTS



1ST OPERATION



2ND OPERATION

When it comes to machining Pulleys on a precision-production basis, there's no more versatile equipment for the job than P&J Tooling on the P&J Automatic. A single Machine can be tooled efficiently to turn out varied jobs with similar operations — such as roughing and finishing all diameters and flat surfaces... boring and reaming holes, whether straight or tapered... facing webs and hubs... forming radii and grooving sheaves to the precise angles specified. For example: a single combination of P&J Tooling on the 5D Automatic (photo above) mass-produces the two Pulleys illustrated (left and right) in a single setup. Heavy lines indicate surfaces machined.

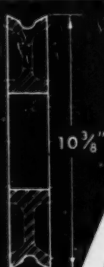
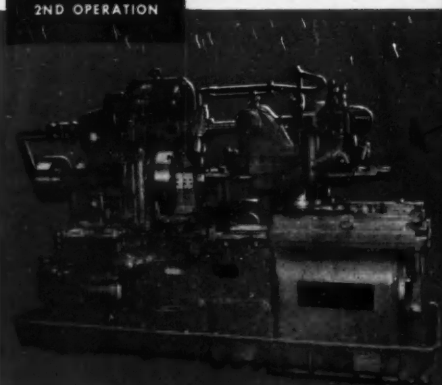
Whatever the size and class of finish — whether single or multi-grooved — P&J Tooling on the P&J Automatic will give you outstanding production and economy. P&J's more than 50 years' experience proves it... so why not send your prints for tooling recommendations and time estimates?



1ST OPERATION



2ND OPERATION



**POTTER &
JOHNSTON CO.**

PAWTUCKET, R.I.
subsidiary of PRATT & WHITNEY
Division Miles-Bement-Pond Company



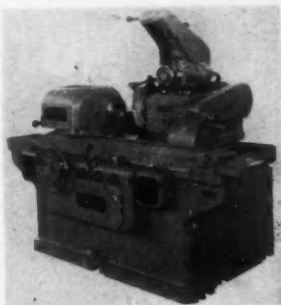
For additional information regarding any of these items, please use coupon on page 64

(Continued from page 60)

the spindle to bore the bushing with the spindle revolving only. Feed rate of the cross slide is 1.0 ipm while feed rate of the spindle is 15.3 ipm.

E-7—Hydraulic Universal Grinder

Major improvements in the 10 in. by 24 in. Type CH hydraulic universal



Landis improved hydraulic universal grinder, Type CH.

grinder manufactured by the Landis Tool Co. of Waynesboro, Pa., include the latest design swinging type internal grinding fixture previously available only on the 12 in. universal grinder. Fixture enables quick change over from external to internal grinding operations. The housing on which the motor is mounted and in which the internal spindle is fitted is hinged to a casting mounted on the wheelbase. The angle is of the tapered bearing type so that any play which may develop can be easily eliminated. The internal fixture is driven by a 1 hp motor. A variety of internal spindles and grinding quills are available.

For operations that require an internal grinding fixture with additional power, a removable type internal fixture is available. This fixture is driven directly from the regular wheel drive motor.

Another new feature is a hydraulic type, rapid wheel positioning mechanism for advancing or retracting the wheelbase. Not a grinding feed, in cases where internal and external grinding is done in one set-up, this mechanism eliminates turning the hand wheel by hand when positioning the grinding wheels. Action is controlled from a lever at the front of the machine, the lever controlling both speed and direction. A safety interlock prevents inadvertent operation during normal grinding set-up.

E-8—Power Transmission Chain Drive

A power transmission chain drive, announced by the Morse Chain Co. of Detroit and Ithica, N.Y., featuring entirely new design principles and called Morse Hy-Vo (high velocity) chain drive, is said to provide for the first time a power transmitting medium combining the dependability of a gear drive with the smoothness and lack of vibration of a belt.

This Morse Hy-Vo is declared to make possible single drive units capable of transmitting as much as 5,000 hp, at linear speeds up to 6,500 fpm, or rotational speeds up to 3,600 revolutions per minute, a Hy-Vo drive only two inches

for over

70

YEARS

TUTHILL

has solved many equipment problems requiring special

SPRINGS

Since 1880 Tuthill has specialized in designing springs to fit every specific need. Whether your spring requirements are for trucks, buses, automobiles, power shovels, farm wagons or dual and triple axle heavy-duty jobs—Tuthill can meet them quickly and economically. And now, MOLYBDENUM DISULPHIDE (MoS₂)... the newest Tuthill extra that keeps springs from squeaking and galling, is an added Tuthill feature that distinguishes this famous line.

Whatever your spring requirements may be — see Tuthill first!

TUTHILL SPRING CO.



760 W. POLK ST.,
CHICAGO 7, ILLINOIS



*use
Bonderite*

**BEFORE YOU
PAINT ALUMINUM**

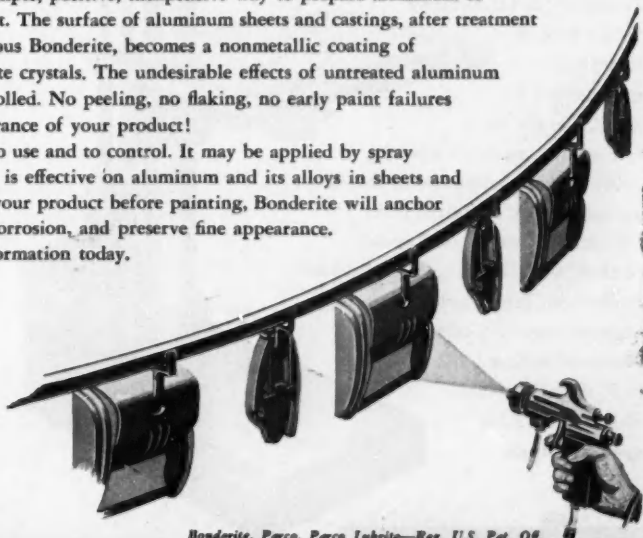
**Famous corrosion resistant paint base ends peeling
and flaking, preserves appearance**

Bonderite is the simple, positive, inexpensive way to prepare aluminum to take and hold paint. The surface of aluminum sheets and castings, after treatment with Parker's famous Bonderite, becomes a nonmetallic coating of fine-grain phosphate crystals. The undesirable effects of untreated aluminum on paint are controlled. No peeling, no flaking, no early paint failures to spoil the appearance of your product!

Bonderite is easy to use and to control. It may be applied by spray or immersion, and is effective on aluminum and its alloys in sheets and castings. Used on your product before painting, Bonderite will anchor the paint, retard corrosion, and preserve fine appearance. Write for full information today.

**Parker Products meet
government specifications**

Available now—a list of government specifications and the Parker Products which meet them. We'll send it free, on request.



Bonderite, Parco, Parco Lubrite—Reg. U.S. Pat. Off.

PARKER

Parker Rust Proof Company

2178 East Milwaukee Avenue, Detroit 11, Michigan

BONDERITE—Corrosion Resistant Paint Base • PARCO COMPOUND—Rust Resistant • PARCO LUBRITE—Wear Resistant for Friction Surfaces

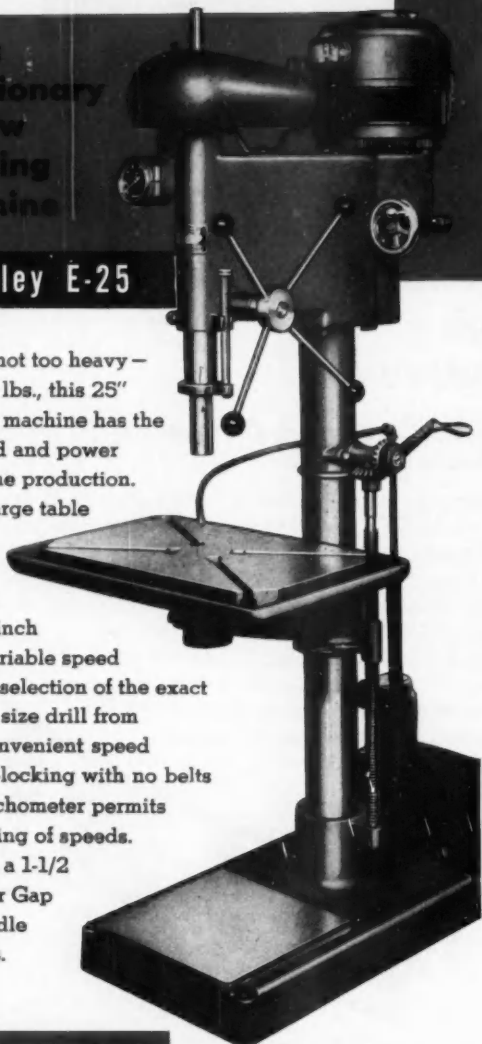
BIG SWING-

MEDIUM WEIGHT

a
revolutionary
new
Drilling
Machine

Sibley E-25

Not too light, not too heavy — weighing 765 lbs., this 25" swing drilling machine has the required speed and power for high volume production. Accuracy of large table with coolant trough is maintained to .0007" in six inch radius. The variable speed drive permits selection of the exact speed for any size drill from 1/8" to 1". Convenient speed control is self-locking with no belts to change. Tachometer permits accurate reading of speeds. Powered with a 1-1/2 H. P. Axial Air Gap Motor. 5 spindle speed options.



SIBLEY MACHINE & FOUNDRY CORP.
18 E. Tutt St., South Bend 23, Indiana
Send Catalog No. 69, Free!

Name _____ Title _____
Company _____
Address _____
City _____ State _____

NEW PRODUCTION AND PLANT EQUIPMENT

For additional information please
use coupon on page 64

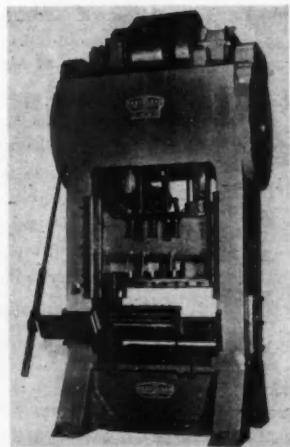
wide having transmitted as much as 500 hp.

Secret of Hy-Vo performance is a new chain-and-sprocket engagement principle that virtually eliminates what is known as "chordal" or polygon action common to the usual chain drive characterized by the company as—a bumping, slapping, jerking action and vibration.

Hy-Vo sprockets also are entirely new in design. Resembling involute gears, they have curved involute teeth which engage the Hy-Vo links with conjugate action.

The Hy-Vo chain incorporates a new, compensating rocking joint with special design features for eliminating slippage and wear. During chain articulation, the joint shifts the pitch-line automatically, engaging the involute sprocket teeth in such a way that the chain follows a path truly tangent to the sprocket pitch line. The result is a smooth, almost vibrationless action.

E-9—Two-Point Press



Put out by the Cleveland Funch and Shear Works Co., Cleveland, Ohio, this No. 25-300-60-42 two-point press, double geared, twin drive, is equipped with electrically controlled, air operated Cleveland drum type friction clutch with spring loaded brake. Provided with a single roll feed and arranged with a pneumatic cushion in the bed, the press has a stroke of 12 in.; adjustment of slide 8 in.; distance from bed to slide, stroke down adjustment up 42 in.; bed area F to B by R to L 48 in. by 60 in.; area face of slide, F to B by R to L, 42 in. by 60 in.; rpm 22; and capacity 300 tons

Let us assume *full, undivided responsibility*

TWENTY-TWO YEARS EXPERIENCE
IN MANUFACTURING PRECISION
HONING EQUIPMENT



MICROHONING MACHINES



MICROHONING FIXTURES



MICROHONING TOOLS



MICROHONING ABRASIVES



DEVELOPMENT-ENGINEERING



TECHNICAL SERVICE



The MICROMATIC HONE CORPORATION has been the principal manufacturer of honing equipment for the past twenty-two years. In that time we have designed and put into production thousands of honing installations.

An active research and development program has always been maintained. This has resulted in the development of a new, more precise, production process—MICROHONING.

We have the most complete line of Microhoning machines, fixtures, tools (all designed and manufactured in our own plant) available anywhere. We stock and process honing stones manufactured by the three largest abrasive manufacturers in the country. This, plus a staff of Engineers and Service Technicians that have the greatest honing know-how of any organization in the world, warrants us asking that you LET US ASSUME FULL, UNDIVIDED RESPONSIBILITY FOR THE RESULTS OBTAINED WITH YOUR MICROHONING EQUIPMENT.

MICROMATIC HONE CORPORATION

3100 SCHOOLCRAFT AVENUE • DETROIT 4, MICHIGAN

District Field Offices: 1323 S. Santa Fe Avenue, Los Angeles 21, California • 206 S. Main Street, Rockford, Illinois • 231 S. Pendleton Avenue, Pendleton, Indiana • MICRO-MOLD Manufacturing Division, Boston Post Road, Gullford, Connecticut • 53 George Street, Brantford, Ontario, Canada

Micromatic *
MICROHONING

*Reg. U. S. Patent Office

Write today for CROSS-HATCH
describing the MICROHONING process

WORLD'S LEADING MANUFACTURER OF PRECISION HONING EQUIPMENT

NEW PRODUCTS

(Continued from page 62)

The Garvin driver is made in 0-100, 0-350, 0-500, 0-750, 0-1500 and 0-2000 in.-lb capacities. Electric, high-cycle or air motors can be specified. The 0-100 in.-lb model is portable. The larger

units are mounted on radial drill press type arms.

Special Garvin drivers are being made with Snap-On attachments for quick change of wrenches for nut "running" to close torque tolerances.

For additional information please
use coupon on page 64

F-5—Army Type Trolley Hoist

Addition to the line of hoists recently announced by the Wright Hoist Division of American Chain & Cable Co., Inc., York, Pa., is the Wright Safeway Army Type trolley hoist made in capacities from $\frac{1}{2}$ ton to 3 tons and available with a special load bar and either a pair of two-wheel plain trolleys or one plain and one geared two-wheel trolley.

The plain trolley assembly has chilled tread wheels equipped with New Departure ball bearings, steel side plate and connections to the load bar. Ad-



Wright Safeway Army Type trolley hoist
offered by American Chain & Cable Co.

justable for a range of beam sizes, it can be changed from plain to geared or vice versa in a few minutes' time, as both the plain and geared mountings are identical.

The geared trolley is constructed the same as the plain trolley type except that the wheels are furnished with gear rings having cut teeth, pinions with cut teeth handwheel, hand chain and hand chain guide. Thrust rollers are mounted to insure proper alignment of the assembly whether on straight or curved track.

The hoist is for service where a close headroom assembly is required.

F-6—Hydraulic Diamond Turner

The Citco hydraulic diamond turner, originally designed for Cincinnati centerless grinders, is now available for Landis Camamatic, I. W. and Heald Internal Grinders, announces the manufacturer, Cleveland Industrial Tool Corp., Cleveland, Ohio. On Heald internal grinders, the turner can be adjusted to 1,600 of one turn per dress, eliminating loss of size on precision internal grinding. It adjusts to three ranges of degree, provides automatic

THE
Balanced SOLVENT...
FOR
ALL JOBS
BLACOSOLV
FOR ALL METALS
OR COMBINATION
OF METALS
ONE PRICE
ONE SOLVENT
IS ALL YOU NEED

**Blakeslee
SOLVENT VAPOR
DEGREASERS**
are more economical
more efficient—USE
LESS SOLVENT

NIAGARA
Metal Parts Washers
for use with cleaning
compounds on either
batch or production jobs.

**HIGHEST STABILIZED DEGREASING
SOLVENT—NOT ALKALIZED!**

BLACOSOLV contains the finest and toughest stabilizers to prevent solvent breakdown. You need not pay premium prices for special solvents for different metals. Blacosolv can be used over and over, under the most rigorous conditions, without impairing its high qualities.

G. S. BLAKESLEE & CO.

1844 S. 52nd Avenue • Chicago 50, Illinois
New York, N. Y. Toronto, Ont.

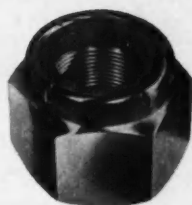


On Battle Roads or Highways ELASTIC STOP NUTS Guarantee Tight Fastenings

Rough terrain and rough handling are hazards to the world famous military 'Jeep'. That's why Willys builds its 'Jeeps' and other vehicles with Elastic Stop Nuts at important points to eliminate fastener failures due to vibration. In this vehicle the famous Red Locking Collar of the Elastic Stop Nut holds firm against vibration—reduces maintenance—on vital applications such as: accelerator hinge, universal joints, body hold down, spring shackles, radiator hold down, and air cleaner. The Red Collar grips bolt threads firmly—protects against vibration, impact, and stress reversal—prevents freezing of nuts to bolts by protecting internal bolt threads against corrosion.

Check the advantages of Elastic Stop Nuts against any other type of self-locking fastener. You'll find that only ESNA offers a complete line of thread sizes and varied nut types engineered to simplify your assembly line fastening problems and to provide your customers with maintenance-free operation.

Whether you are manufacturing equipment for rough military use or designing better performance and easier maintenance into equipment for your normal market . . . use vibration-proof fasteners. Now is the time to get full information. Write for complete product line bulletin to Elastic Stop Nut Corporation of America, 2330 Vauxhall Road, Union, N. J.



DESIGN AHEAD WITH ESNA

THE FAMOUS RED ELASTIC COLLAR IS VISIBLE EVIDENCE OF LOCKING SECURITY

Threadless and permanently elastic, it provides these 4 outstanding features:

1. Protects against nuts loosening due to VIBRATION
2. Keeps locking threads CORROSION FREE
3. Provides for accurate BOLT LOADING
4. Seals against LIQUID LEAKAGE along the bolt threads

And can be used again and again



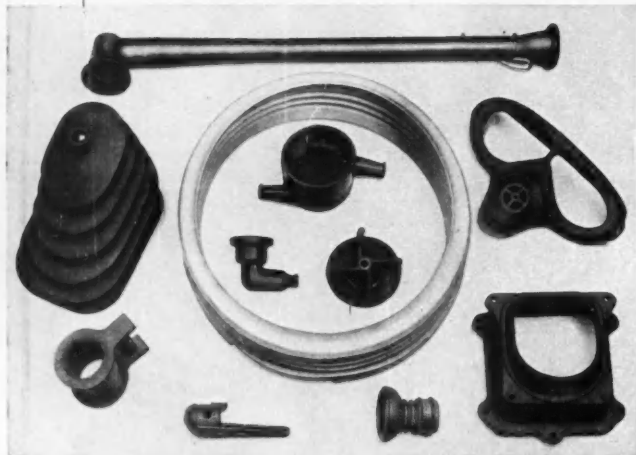
ELASTIC STOP NUTS

DESIGN HEADQUARTERS FOR SELF-LOCKING FASTENERS



Acushnet

**finds the answer to
unusual Rubber problems**



Intensive specialized research in Acushnet laboratories enables us to develop and furnish stocks of unusual properties and characteristics which make possible the use of rubber in applications where it has not been considered previously.

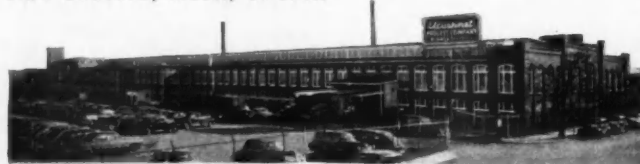
Supplementing the skill of our compounders are Acushnet's extensive quality controlled production facilities that assure precision molding of natural and synthetic rubber parts to the most exacting specifications. All

Acushnet products are made on order, none are stocked.

Acushnet
PROCESS COMPANY
New Bedford, Mass., U. S. A.



*Rubber Handbook
sent on request*



Address all communications to 754 Belleville Ave., New Bedford, Mass.

NEW PRODUCTS

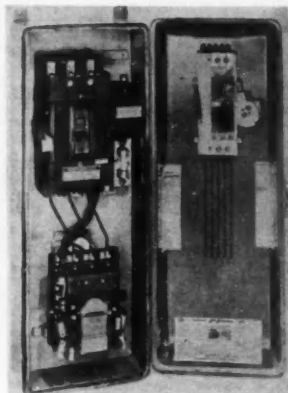
*For additional information please
use coupon on page 64*

control which splits segments at the completion of each turning cycle, and is declared to maintain a new and ever ready cutting edge.

F-7—Starter For Machine Tools

Available from Westinghouse Electric Corp., Pittsburgh, Pa., is a new combination Life-Line-starter (Class 11-206-NJ) for improved starting and control of machine tools, presses, and other equipment used in mass production industries.

Designed to meet requirements of the J. I. C. Electrical Standards for Industrial Equipment and the Machine Tool Electrical Specifications (as modi-



Westinghouse combination Life-Line-starter (Class 11-206-NJ).

fied by the Mass Production Industry Electrical Specifications), the unit is offered in NEMA sizes 1 through 5, with ratings up to 200 hp, 440 volts polyphase.

To keep out dirt, oil, and splashing coolant, the starter's NEMA type 12 enclosure has a continuous neoprene gasket and is mounted by external brackets—no knockouts or mounting holes in the box itself. The breaker is operated by a slam-proof, self-indicating external handle, but the enclosure must be opened to reset overload relays, which brings motor overload to authorized person's attention.

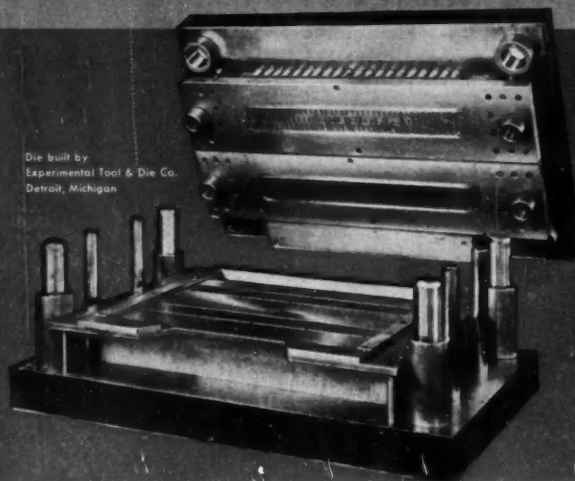
The starters are furnished as standard with a 220/440-volt primary, 110-volt fused secondary, control circuit transformer that can be used on either 220- or 440-volt supply voltage, 50 or 60 cycles.

(Turn to page 76, please)

AUTOMOTIVE INDUSTRIES, July 1, 1951

PIECE PART REJECTIONS REDUCED

Diemakers at Experimental Tool & Die Company solved a costly repair soldering problem on these stamped radiator heads with the die shown below. Precision was the secret. Die tolerances were held to within .0001" and all die components had to be interchangeable. That's why they specified...



Die built by
Experimental Tool & Die Co.
Detroit, Michigan

90%



DIEMAKERS' SUPPLIES and PRECISION DIE SETS



Die Sets



Dowel Pins



Die Springs



Cap Screws



Stripper Bolts

CALL ON THE DANLY BRANCH CLOSEST TO YOU FOR FAST LOCAL SERVICE

- *CHICAGO 50, 2100 South Laramie Avenue
- *CLEVELAND 14, 1550 East 33rd Street
- *DAYTON 7, 3196 Delphos Avenue
- *DETROIT 14, 1549 Temple Avenue
- *GRAND RAPIDS, 113 Michigan Street N.W.
- INDIANAPOLIS 4, 5 West 10th Street
- *LONG ISLAND CITY 1, 47-28 37th Street
- *LOS ANGELES 54, Ducommun Metals & Supply Co.,
4890 South Alameda
- MILWAUKEE 2, 111 East Wisconsin Avenue
- PHILADELPHIA 44, 18 West Chelton Avenue
- *ROCHESTER 4, 16 Commercial St.

*Indicates complete stock

Diemakers everywhere depend on Danly precision. Every Danly product—die sets, dowel pins, die springs, cap screws, stripper bolts—is designed to complement the finest die work. For complete, reliable service, come to Danly!



DANLY MACHINE SPECIALTIES, INC.

2100 South Laramie Avenue, Chicago 50, Illinois

DUALOY

THE BI-METALLIC MOLECULAR BONDED PISTON

EVIDENCE

TYPICAL TEST HISTORIES ILLUSTRATE DUALOY SUPERIORITY

TEST PROCEDURE: Heavy duty engine overhauled with pistons purchased from Automotive Parts Distributor's Stock. DUALOY and conventional pistons installed in alternate cylinders. Test installation then subjected to normal commercial transport operational practices. Upon ring or piston failure all conventional pistons removed and replaced with DUALOY. Engine then placed in normal service until next operational interruption.



◀ HIGHWAY TRANSPORT ▶

Case 2: Number 2 cylinder failed at 41,078 miles. No compression, high oil consumption. Three conventional pistons replaced with DUALOY and unit put back in service.

Case 2: Engine overhauled after 189,428 miles. DUALOY pistons re-ringed and reinstalled in same engine. Reason for overhaul: 12 months' operational overhaul.



◀ BUS TRANSPORTATION ▶

Case 4: Number 6 cylinder. Piston ring failure at 68,562 miles. Number 4 piston also showed excessive top ring groove wear, but ring still intact. Three conventional pistons replaced with DUALOY.

Case 4: Engine overhauled after 176,691 miles. All pistons reinstalled with same rings. Reason for overhaul: Bearing failure.



◀ INTERSTATE TRANSPORT ▶

Case 5: Number 1 and 2 cylinders. (Piston from cylinder 3 shown.) Ring failures at 52,349 miles. Conventional pistons replaced with DUALOY and unit resumed schedule operations.

Case 5: Engine overhauled after 207,114 miles. Cylinders rebored .060 oversize. DUALOY pistons re-ringed and reinstalled. Reason for overhaul: Seasonal overhaul.

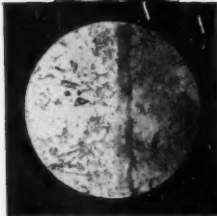
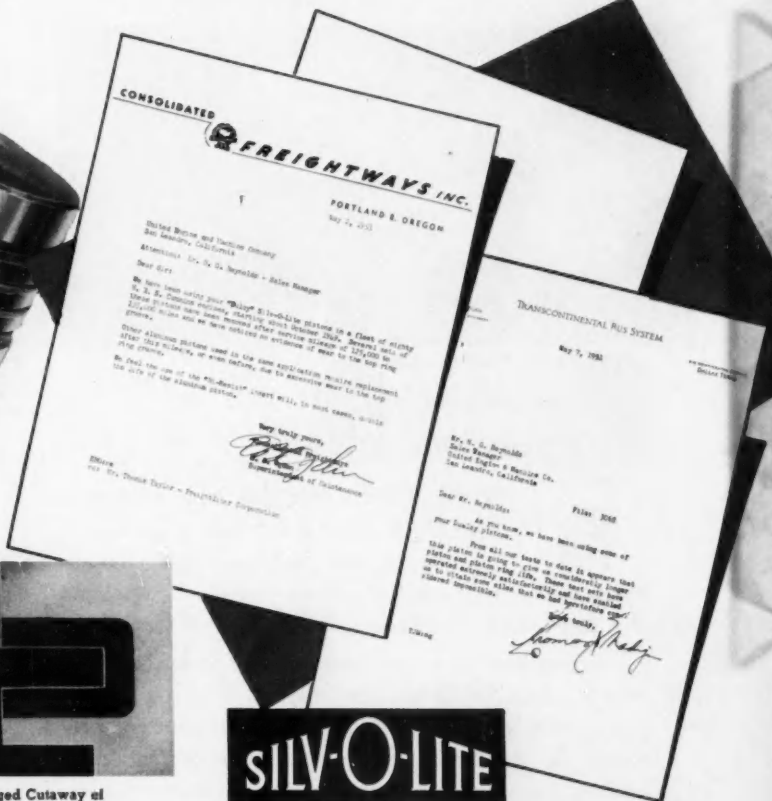


UNITED ENGINE AND MACHINE COMPANY

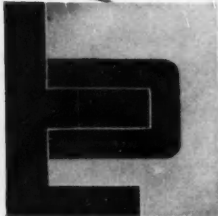
310 PREDA STREET • SAN LEANDRO, CALIFORNIA

DUALOY VERDICT

OF COST CONSCIOUS FLEET OWNERS AND OPERATORS
INSTALL DUALOY PISTONS for longer life, freedom from excessive top ring groove wear and top ring failures.
DUALOY, the bi-metallic piston with the molecular bonded top ring carrier — HAS NO EQUAL.



**Photomicrograph of
Bi-metallic Molecular Bond**



**Enlarged Cutaway of
Ni-resist Ring Groove**

SILV-O-LITE

SILV-O-LITE has the most complete line of passenger car and heavy duty pistons available. Heavy duty types are available with or without DUALOY*, according to your requirements for top ring land protection.

Send for Catalog 23 and DUALOY* literature

*Trademark Registered.
 *The United Engine & Machine Company (manufacturers of Silv-o-lite pistons) are licensed by Fairchild Engine & Airplane Corporation under patents 236730 and 2455457 to use the Al-lin process in the manufacture of bi-metallic molecular bonded pistons

UNITED ENGINE AND MACHINE COMPANY
 310 PRED A STREET • SAN LEANDRO, CALIFORNIA

NEW PRODUCTS

(Continued from page 72)

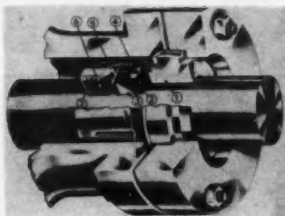
F-8—Mechanical Shaft Seal

A high temperature, anti-corrosive mechanical shaft seal designated Type 9 and incorporating a Teflon sealing

member is announced by Crane Packing Co., Chicago, Ill.

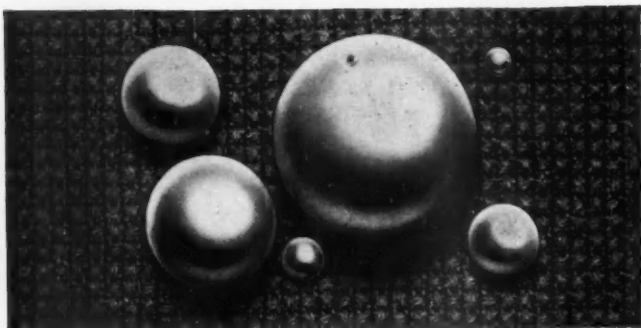
Rather than a leather or synthetic rubber member, the Type 9 seal incorporates a flexible ring molded from the new plastic, Teflon. The Teflon "wedging," is said to combine the chemically-inert properties of Teflon with the flex-

For additional information please
use coupon on page 64



Crane mechanical shaft seal, Type 9

a metal ball PROBLEM?



Let **STROM**
Work It Out For You



Whether it is a precision ball bearing or one of the other many ball applications in industry, your problem will not be entirely new. Strom has been in on many ball problems and knows the importance of the right ball for the job.

Strom has been making precision metal balls for over 25 years for all industry and can be a big help to you in selecting the right ball for any of your requirements. In size and spherical accuracy, perfection of surface, uniformity, and dependable physical quality, there's not a better ball made.

Strom STEEL BALL CO.
1850 So. 54th Ave., Cicero 50, Illinois

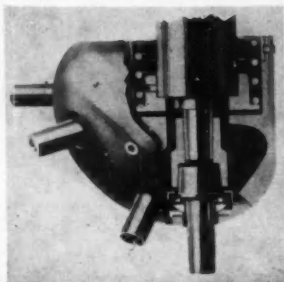
Largest Independent and Exclusive Metal Ball Manufacturer

ibility and positive sealing components essential to effective mechanical sealing. The Type 9 seal has been designed for service on various rotating shaft applications, such as centrifugal pumps, turbines, positive displacement pumps and agitators. It can be employed at temperatures up to 500 F. Construction of the seal is shown in the cut-away drawing: The set-screwed metal retainer (7) provides a positive drive from shaft to carbon sealing washer (2) through dents (4) which fit into washer notches. An effective seal between the shaft and washer is insured by the precision-machined Teflon wedge ring (3) which is pre-loaded by the action of multiple springs (6) Spring pressure is uniformly distributed by a metal disk (5). The lapped raised face of the rotating sealing washer (2) mates against the highly lapped face of the stationary seat (1) to provide a positive leakproof seal with minimum running friction between the vertical faces. Spring pressure keeps the faces in constant contact providing automatic adjustment for wear and shaft end play.

F-9—Redesigned Turret Bearings

Redesign of bearings in the Lign-o-matic turret, manufactured by Howe and Fant, Inc., So. Norwalk, Conn., is said to substantially increase the life and precision of this self-centering turret for drilling machines.

The bearings permit the Lign-o-



Lign-o-matic turret cutaway view showing bearing design and self-centering feature.



Large Carbide and Tungsten Carbide Tools

Small Tungsten Carbide Cutting Tools

Small Tungsten Carbide Cutting Tools



Small Tungsten Carbide Cutting Tools



Small Tungsten Carbide Cutting Tools



Small Tungsten Carbide Cutting Tools



Small Tungsten Carbide Cutting Tools



Small Tungsten Carbide Cutting Tools



Small Tungsten Carbide Cutting Tools

Small Tungsten Carbide Cutting Tools



Small Tungsten Carbide Cutting Tools

Continental

"PRODUCTION TESTED" CUTTING TOOLS

Continental cutting tools and broaches are at work day after day on production jobs in Ex-Cell-O plants. This "production testing" is one reason for the consistently superior results you get when you specify Continental. Equally important are two other factors:

Expert design, by Continental's experienced staff of tool and broach engineers.

Efficient processing, including careful

heat treating, in the Continental plant; skilled craftsmen working with modern machine tools.

The Continental line includes standard and special cutting

tools, broaches and broach fixtures. Order standard tools from the Continental catalog. For specials call your Ex-Cell-O representative or write to Continental.

CONTINENTAL TOOL WORKS



DIVISION OF EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN



looking for someone
who can put
PLASKON ALKYD parts
in your hand?

We can—whether you need a few parts or more than a few million. Design? Tooling? We'll take care of it, along with any other problems that come up in producing Alkyd or other thermosetting plastic parts. If you need parts with the excellent characteristics of Plaskon Alkyd, one of our engineers will be glad to talk facts and figures with you. Just write, wire, or phone. Or let us know when you'd like to have our plane and pilot whisk you to our plant to discuss your parts problems. No obligation, naturally.

when you look for
plastic moldings,
look first to...



plastic research products, urbana, ohio

NEW PRODUCTS

For additional information please
use coupon on page 64

matic spindles to move laterally and angularly, as well as to rotate. When the drilling machine spindle is lowered, the tapered surface of a driver (rigidly mounted on the drilling machine spindle) engages the mating tapered surface of a turret spindle. Bearing construction allows the turret spindle to be moved into exact alignment with the drilling machine spindle. The turret spindle is locked in position and cannot get out of alignment during the drilling operation.

The construction is stated to provide sustained accuracy equal to the drill press itself.

Reduced over-all run-out is said to be less than 0.0001 in. Hollow spindles reduce weight and permit sustained accuracy at high operating speeds.

As in previous models, the new Lign-o-matic can be indexed, without stopping the motor, faster than tools can be changed or work moved to another spindle. As a result, it is declared, a Lign-o-matic turret mounted on a single spindle will release five drilling machines for other work and still show increased production and reduced costs on the original job.

Lign-o-matic fits any standard drilling machine without altering the machine. A single turret handles up to six different operations, such as drilling, reaming, counterboring, and tapping (on reversible spindle machines), up to 1/2 in. in dia in any material.

F-10—Four SR-4 Pressure Cells

Four SR-4 pressure cells in capacities up to 100 lb per sq in. have been redesigned by Baldwin-Lima-Hamilton

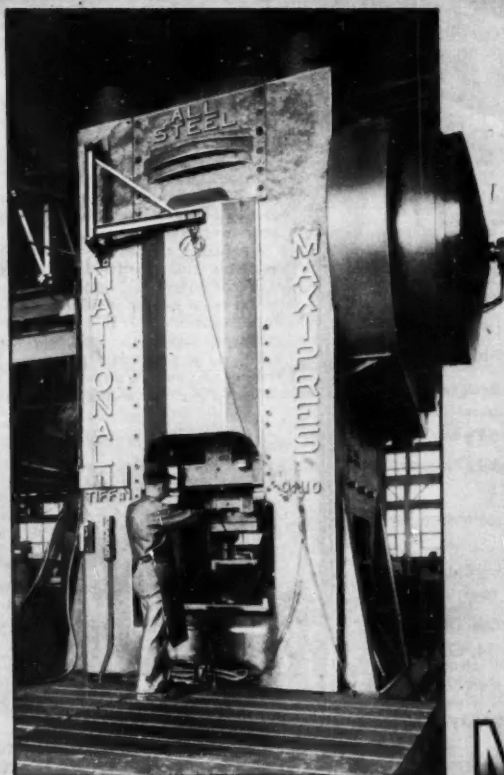
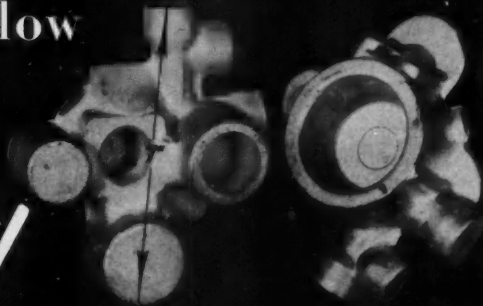


Baldwin SR-Y pressure cells, Type E.

Corp., Phila., to make them insensitive to linear acceleration and to position. Capacities of these cells, known as Type E, are 10, 20, 50, and 100 lb per sq in. Their operation is based on SR-4 resistance wire strain gage measurement with four-arm Wheatstone bridge. Measuring range extends from absolute vacuum to full rated pressure, except

This Intricate Brass Forging Made in One Blow

on a
**NATIONAL
6A MAXIPRES!**



Forging operation at Mueller Brass Co.,
Port Huron, Michigan

● The Mueller Brass Co., Port Huron, Michigan, makes this difficult brass valve forging in only one blow at a rate of 300 forgings per hour on a National No. 6A MAXIPRES. The original billet measures 3-9/16 inches round by 5-7/16 inches long. (16.6 lbs.)

Successful master-forgers of brass and bronze, and pioneers in the development of specialized forging techniques, the Mueller Brass Co. relies upon the dependability of five MAXIPRESSES for a large share of its forging output.

If you have a forging problem—hot or cold, ferrous or non-ferrous—let us help you with it. Send us prints or a sample of the part you wish to forge. Better yet, visit us. No obligation.

NATIONAL

MACHINERY COMPANY
TIFFIN, OHIO.

DESIGNERS AND BUILDERS OF MODERN FORGING MACHINES—MAXIPRESSES—COLD HEADERS—AND BOLT, NUT, RIVET, AND WIRE NAIL MACHINERY

Hartford

Detroit

Chicago

NEW PRODUCTS

For additional information please
use coupon on page 64

in standard units of lowest capacity for which the range is limited to ± 10 lb per sq in. Pressure cells meeting other requirements are made to order.

Of two types of cells Type ES321 has all parts in contact with the pressure fluid made of type 321 stainless steel,

and Type EMB has pressure bellows of Monel and brass pressure fittings leading to the bellows. Pressure connections for each are through a standard $\frac{1}{8}$ -in. male pipe thread.

Type E pressure cells are designed for standard 120-ohm circuit. Recommended

input voltage is 5 volts but a maximum of 8 volts may be used. Open-circuit output voltage is $2,000 \pm 0.005$ millivolts per volt input to the bridge for capacity pressure. Cells are temperature compensated for zero and span and calibration accuracy is within $\frac{1}{4}$ per cent of full scale at any point within rated range. Maximum temperature for full accuracy in continuous operation is 150 F.

Pressure cells are enclosed in an aluminum box $3\frac{1}{4}$ by $3\frac{1}{4}$ by 1 $\frac{1}{2}$ in., with pressure inlet and electrical connections on opposite sides.



BUILT TO TAKE IT!

Leece-Neville quality electrical equipment is designed and built to take the toughest conditions . . . and keep on performing. That's the reputation it has earned in over forty years of heavy-duty leadership. Leece-Neville builds:

GENERATORS from 60 to 2,000 watts, for 12-volt standard systems and 12-24 volt series-parallel systems. Shown above: 14 volt, 40 ampere, low cut-in Generator.

CRANKING MOTORS from $\frac{1}{2}$ H.P. to 27 H.P. Illustrated is motor for 12 volt and 12-24 volt systems.

VOLTAGE REGULATORS of rugged construction for heavy duty service.

SWITCHES, hand and magnetic, for standard 12 volt systems and for 12-24 volt series parallel systems.

For complete information, just write Dept. 27, The Leece-Neville Co., Cleveland 14, Ohio.



Pioneer and STILL Quality Leader

Leece- Neville

F-11—Differential Converter

A compact and lightweight transmitter called a differential converter has been designed by Minneapolis-Honeywell Regulator Co., Phila., Pa., for more sensitive measurement and control of fluid flows in many industrial processes.

The unit has a continuously adjustable range from 0-20 to 0-200 in. of water (differential pressure) and provides this 10 to 1 change of range with no change of parts. Field calibration of any range is possible by the use of scale-type weights which eliminate need for a water column.

Operating on the pneumatic-balance principle without mercury, the differential converter employs an accurate weigh-beam system in which the differential pressure, due to fluid flow at the metering orifice, is continuously balanced by a pneumatic pressure. This pressure becomes a measure of the fluid flow and is connected to a recording or



Honeywell Brown differential converter

controlling instrument. Extremely fast speed of response to rapid changes in flow is the prime feature claimed for the system.

The forged body of the unit is offered with a 750 or 1500 psi rating in Type 316 stainless steel or carbon steel. Volume displacement in the meter is said by Honeywell's Brown engineers to be so small that seal pots or condensing chambers can be eliminated in most installations and the amount of purges, where required, greatly reduced. Permitting location close to orifice connections, usually without seal pots, the

PRECISION by the PILE



WITH
NAMCO
GROUND THREAD
CIRCULAR CHASER
VERS-O-TOOLS

When you use Vers-O-Tools, these workpieces are so typical that we lump them all together and measure them as precision in bulk. More properly, the samples of successful Vers-O-Tool work would be measured in terms of *tons*—for we've licked many a tough production problem: pressure-tight threads, dry-seal threads, API threads . . . and for all uses including aircraft, munitions, tanks, rockets, fine instruments as well as the usual commercial parts.

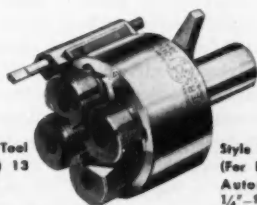
This is no ordinary success story. The selection of Vers-O-Tools for each of these applications is based on a proved-in-use record of superiority on each of three counts: accuracy and fine finish, longer tool life, increased production. These, in turn, stem directly from the Vers-O-Tool's unique design and construction features. For complete details on how Vers-O-Tools ground-thread-chaser can improve quality and cut costs in your shop, ask for catalog D-51.



Style DS Vers-O-Tool
(Nonrevolving Type) 9
sizes, $\frac{3}{8}$ "- $\frac{4}{8}$ "



Style DR Vers-O-Tool
(Revolving Type) 13
sizes, $\frac{3}{16}$ "- $\frac{4}{8}$ "



Style DBS Vers-O-Tool
(For Brown & Sharpe
Automatics) 3 sizes,
 $\frac{1}{4}$ "- $\frac{9}{16}$ "

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley 4-6 and 8 Spindle Bar and
Chucking Automatics • Single Spindle
Automatics • Hydraulic Thread Rolling
Machines • Automatic Threading Dies and
Taps • The Chronolog • Limit, Motor Starter
and Control Station Switches • Solenoids
Centrifuges • Contract Manufacturing

Give them the tools...
they'll do the job!



• Converting from ordinary hand wrenches to a Buckeye air wrench on just two assembly operations has meant a 20% increase in assembly line output for Lambert Products, Inc. These jobs are handled solely by women, using a lightweight, easy-to-handle Buckeye air wrench.

Equally important to this nationally-known manufacturer of hand and power mowers is the fact that

employees are far less fatigued, do more and better work in less time, at lower cost.

The right kind of Buckeye Tools may help solve many of your manpower, production and assembly line problems. Since there's no obligation, wouldn't it be wise to have our representative give you all the helpful facts? His name, and our catalog will be sent on request.

Buckeye Tools
CORPORATION

DIVISION 21 • DAYTON 1, OHIO

IN CANADA: Joy Manufacturing Co. (Canada) Ltd., Galt, Ontario

Portable Air
and Electric Tools
for Industry

NEW PRODUCTS

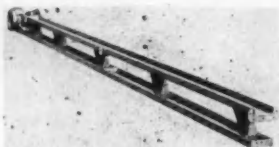
For additional information please use coupon on page 64

differential converter is said to provide considerable savings in installation and maintenance and a high degree of control.

F-12—Oscillating Trough Conveyor

For handling a great variety of loose bulk materials at moderate capacities, the Link-Belt Co. of Chicago, Ill., is now in production on a new conveyor of oscillating trough type, called Link-Belt Flexmount.

Conveyor construction is declared ideal for handling chemicals and other material where cleanliness, contamination or corrosion is a factor. Very hot, sharp, jagged or oily material, such as



Link-Belt Flexmount oscillating conveyor.

steel chips and turnings, are handled with virtually no wear of metal troughing, it is said. Escape of dust or gases can be eliminated by addition of a metal cover with flexible connections at loading and discharge points.

The Flexmount design provides use of a one-piece metal trough with high sides, supported on simple one-piece flexible members which function as springs in absorbing the energy of the trough movement at each end of the stroke.

The conveyor trough is normally four in. deep and can be furnished in standard widths of 8 to 24 in. made of No. 10 or 12 gauge steel, stainless or corrosion resisting steel, or other special material. Motion is imparted to the trough by a roller-bearing, constant-stroke eccentric.

Uniform, continuous flow of material is declared assured regardless of overloads or surges, the gentle handling action causing no degradation of thin or brittle material.

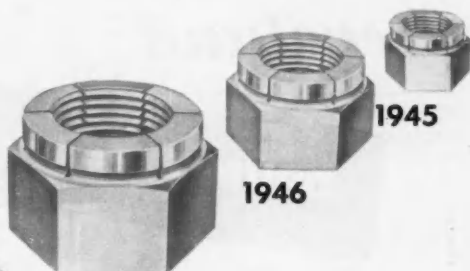
The trough oscillates at the natural frequency of the Flexmounts, reducing the reaction forces on the drive to a minimum and requiring only the hp necessary to convey the material.

Troughs in lengths up to 100 ft can be furnished, and dividers installed to convey several materials simultaneously. Discharge is possible at any point.



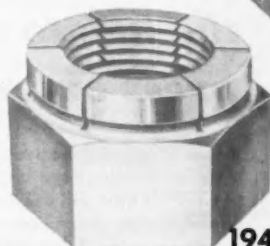
SELF-LOCKING NUTS

"They won't work loose!"

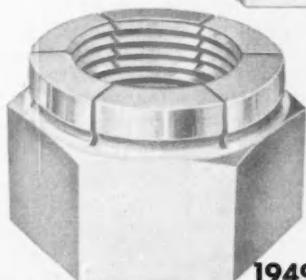


1945

1946

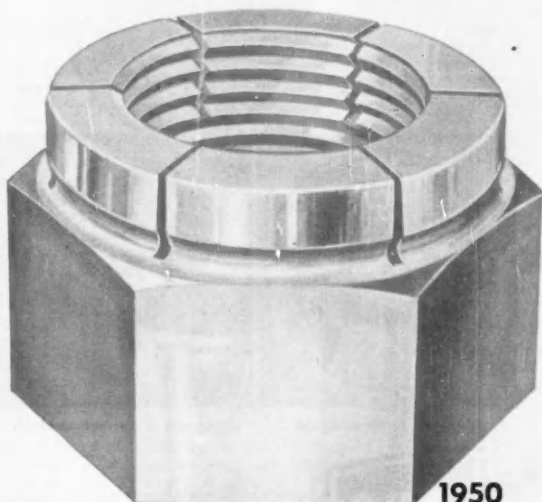


1947



1948

1949



1950

GROWING in importance...

You'd be surprised at the number of new accounts we add each week for FLEXLOC—our one-piece, all-metal, stop- and lock-nut that "won't work loose!"

Nearly every branch of industry is represented, and there is unquestionably a rapidly growing preference for self-locking nuts that won't unwind, once they have been tightened.

This is because nuts that stay tight promote uninterrupted production and cut maintenance costs—two important economy factors.

FLEXLOC features include: one-piece, all-metal construction—nothing to shift, work loose, or forget; resilient, automatic-acting locking sections that are responsible for FLEXLOC's closely controlled torques; positive, ample resistance to the most chattering vibration; and last but not least, the fact that the FLEXLOC Lock-Nut can be reused a great many times.

Our FLEXLOC Catalog No. 619-A tells the whole story. It's yours for the asking. And if you'd like some sample FLEXLOC Nuts, we'll be glad to send them.

SPS

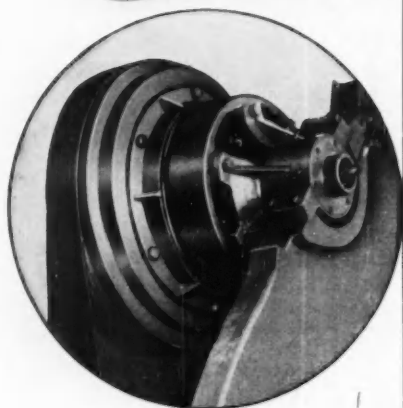
STANDARD PRESSED STEEL CO.

JENKINTOWN 53, PENNSYLVANIA

Cleveland

DRUM TYPE Friction Clutch and Brake

the key to economical press operation



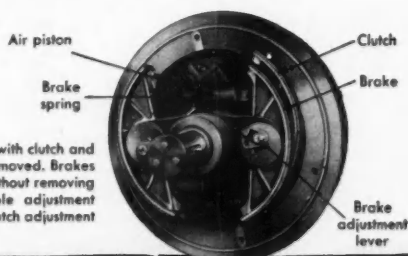
*11 OUTSTANDING DESIGN ADVANTAGES

- Clutch and Brake cannot engage simultaneously ... always FULL Clutch or FULL Brake.
- Simplified maintenance ... less down-time for there is a minimum number of parts.
- Less power is required for clutch operation due to lightweight construction.
- Drum type design assures quicker starts and stops.
- Longer friction life is assured ... as all idle friction surfaces are completely disengaged eliminating drag, unnecessary wear and destructive heat.
- Clutch and Brake adjustments are easily made.
- Entire unit can be serviced without removal from press.
- Air cylinders provide maximum performance with minimum amount of air.
- Spring-loaded Brake brings slide to immediate stop in event of current or air supply failure.
- Clutch temperature remains relatively cool—no wear from excessive heating.
- So designed that it can be installed on most Cleveland presses, new or old.

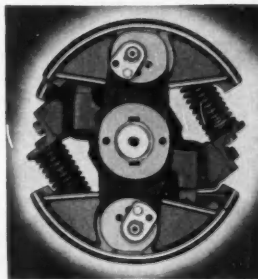


Advanced design of the patented Cleveland Drum Type Friction Clutch and Brake offers 11 features* for increased efficiency and economy of press operation. Actual performance records prove that the air operated Cleveland Drum Type Friction Clutch contributes to greater press efficiency, reduced down-time and lower press operating costs. Specify Cleveland Drum Type Friction Clutches and Brakes. They can be installed on most Cleveland presses, new or old. Complete information on request.

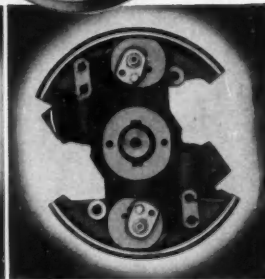
A-1105



Cleveland unit with clutch and brake drums removed. Brakes can be reset without removing drums by simple adjustment of lever pin. Clutch adjustment is automatic.



Clutch and brake combined.



Clutch with brake shoes removed.

THE CLEVELAND
PUNCH & SHEAR WORKS CO.
U.S.A.

Established 1890

..... POWER PRESSES

PUNCHING TOOLS & DIES

OFFICES AT:
NEW YORK... CHICAGO
DETROIT... PHILADELPHIA
& LANSING

FABRICATING TOOLS

CLEVELAND 14, OHIO

NEW PRODUCTS for AIRCRAFT

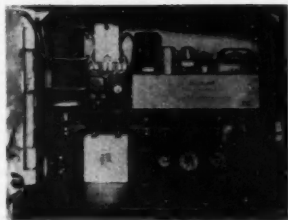
FOR ADDITIONAL INFORMATION regarding any of these items, please use coupon on PAGE 64

S-1—High Speed Pen Recorder

Developed by Minneapolis-Honeywell Regulator Co., Phila., Pa., is a new electronic, high-speed pen recorder for measuring rapidly changing variables experienced in laboratory and test applications.

Full-scale signals which vary as rapidly as 20 cycles a minute can be recorded on the new model, also those with peak-to-peak amplitude of 10 per cent of scale which vary as rapidly as three cycles a second.

The new device, provides accurate recording in rocket engine testing where



Minneapolis-Honeywell high-speed recorder, interior view, showing amplifier and damping circuit components.

thrust of the engine is measured with a strain gauge. It will be applicable for analyzing fuel efficiencies and engine designs, and for spectrographic and other analyses where relatively high scanning rates and narrow increments of change are encountered in a measured variable. It is also used for determining instantaneous rates of flow as in jet engine development.

S-2—Sealers for Fuel Tanks

Two sealers for aircraft integral fuel tanks—specially compounded to be light tan instead of black—are announced by Minnesota Mining and Mfg. Co.'s Adhesives and Coatings division in Detroit, Mich.

The sealers—EC 1120 and EC 1130—are designed for the original sealing and the re-sealing of fuel tanks, and meet the requirements of U. S. Air Force specification 14153, it was announced. Both are oil- and fuel-resistant.

Both sealers have a synthetic rubber

base. EC 1120 resembles a light syrup, and is applied by brush; EC 1130 resembles a thick syrup, and is designed

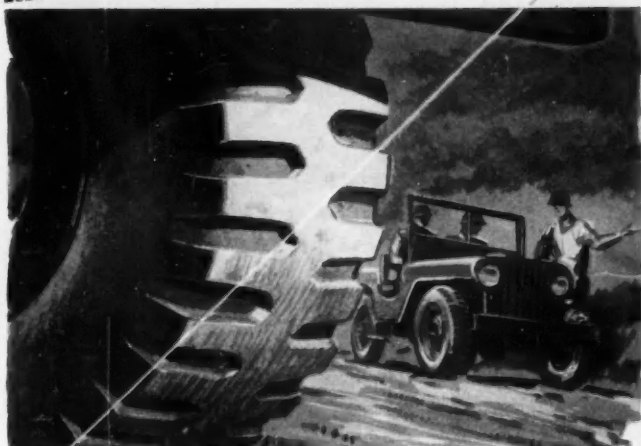
for caulking gun application.

Snap bend tests with 3/4-in. films show that the sealers retain consider-



MAGNECORD

Sound Research



SENDS A TIRE TO THE FRONT

Tough mud-slogging tires roll our forces toward the front. Behind rugged-duty tires lie months of sound research with Magnecord tape recorders . . . vibration tests to determine the wear and performance of new tires in development. Precision testing demands the finest precision tape recording. Whatever your recording problem, Magnecord offers greater flexibility, fidelity, features. Available for subsonic, audio or supersonic research, Magnecord can fill your most exacting requirements.

Magnecord, Inc.

HIGH FIDELITY TAPE RECORDERS FOR INDUSTRY

Write for New Catalog

Magnecord, Inc., Dept. IA-7 360 N. Michigan Ave., Chicago 1, Ill.
Send me further information on Magnecord tape recording for industrial "Sound" Research.

Name.....
Company.....
Address.....
City..... State.....

Used by more engineers than all other professional tape recorders combined.



VITAL



R_x SPRING TONIC

We've been diagnosing spring problems for 61 years and industry has thrived on our prescriptions. Recommending the right springs for people like yourself is an old habit with American-Fort Pitt engineers. The American-Fort Pitt Springs that you specify will ease and speed assembly of your product and contribute to its good name. Mechanical springs is our specialty—and we produce them in a modern plant, employing advanced metallurgical techniques.

When it's spring time, give us a ring.

AMERICAN-FORT PITT SPRING DIVISION
H. K. Porter Company, Inc.
 No. 2 John St., McKees Rocks, Pa. (Pittsburgh District)

**AMERICAN-FORT PITT
SPRINGS**

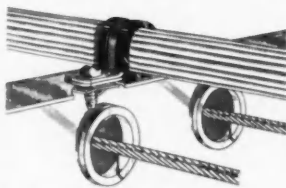
New AIRCRAFT PRODUCTS

For additional information please use coupon on page 64

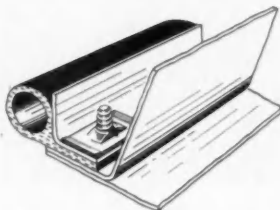
able flexibility and adhesion at temperatures as low as 105 F, and can be bent over a 2-in. mandrel at -70 F without failure, the firm reports.

S-3—Flat Type Speed Fasteners

Production of flat type aircraft SPEED NUTS, said to save as many as



Tinnerman flat type Speed Nuts, as used for attaching various harness clamps to bulkhead rings.



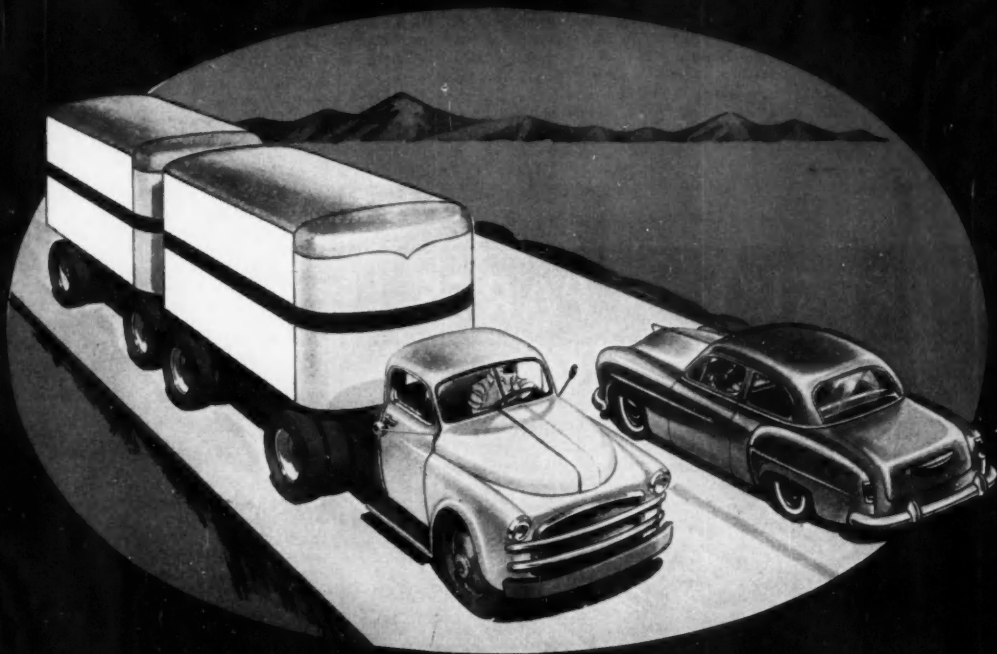
Tinnerman flat type Speed Nuts as used in fastening of seal strip.

three man hours for every 1000 fastenings, are announced by Tinnerman Products, Inc., Cleveland, Ohio. These self-locking, weight-saving fasteners are interchangeable with AN 364 and AN 365 nuts on screw driven non-structural applications. The ends of the aircraft flat type are turned upward to prevent scoring of aluminum surfaces.

In fastening of seal strips, these SPEED NUTS provide a greater, highly desirable bearing surface. They are also claimed ideal for attaching various harness and tube clamps to bulkhead rings, etc., because only finger-tip pressure is required to hold them in position while the screw is being driven. Hand wrenches to prevent nut rotation are eliminated—a significant cost-reducing feature in applications where accessibility is limited.

Tinnerman aircraft flat type SPEED NUTS are listed in NAS 446 standards for 4,6,8 and 10B (Z) tapping screws. The 10B type takes an AN 530 screw with a tapered lead and coarse threads for quicker starting and faster driving.

"DETROIT" Universal Joints . . .



. . . for Light Cars or Heavy Trucks

Because today's high compression engines and greater power demands place a severe strain on drive trains, "DETROIT" Universal Joints are designed in many sizes and types to best serve specific requirements.

Detroit



UNIVERSAL JOINTS



UNIVERSAL PRODUCTS COMPANY, Inc., Dearborn, Michigan

METALS

(Continued from page 39)

muddled. While approval has been given for a 27½ cent per lb price to Chilean producers, no consideration has been given to the fact that prices for copper in Europe are from seven cents to 20 cents above the domestic ceiling of 24½ cents and normal supplies of the metal from South American, Canadian, and African sources are going to markets where higher prices are currently paid.

As was anticipated when the Chilean

price was raised, Canadian copper producers promptly demanded and received the same price for their metal. The Canadian price was advanced to 27½ cents, which with the discount in Canadian funds, brought it to 29½ cents. The Granby Copper Co., one of the principal producers, which had been selling its concentrates to an American smelter at the ceiling price, promptly withdrew a portion of its copper and was able to sell it abroad

at 45 cents per lb. Noranda, Canada's largest copper producer, advanced its price to 27½ cents on June 2. However, these advances are not effective at once as the big Canadian mines sell most of their output under contract, which in some cases are based on the 24½ cent price.

According to a statement by a top official of OPS, their opposition to a price increase in copper rests on the belief that the copper industry's earnings are too high to qualify for an increase under the standards. Without attempting to dispute this statement, it is abundantly true that domestic copper production, now currently 90,000 tons a month, is still far unable to supply domestic, military, and stockpile demand which averaged about 133,000 tons a month in 1950 including stockpile deliveries. The deficit must be made up by imports. The only way to obtain imports is to pay a competitive price. If this is higher than the ceiling price, it's unfortunate, but it's hard to see how any other course is open.

PRECISION PARTS

As long time manufacturers of jig bushings and components for diesel engine parts, cam rollers, etc., we are equipped to produce a wide variety of similarly related precision parts • Our facilities include automatic blanking, heat treating, centerless and cylindrical internal and external grinding, a variety of honing and lapping machinery — and the most modern types of precision inspection equipment • Our Engineers are well versed in the processing of correct steels for specific applications — making due allowance for shock resistance and wear and abrasion — as well as for cost.



Hardened Roller



Precision Paper Slitter



Special Bushing for diamond dressing attachment



Hardened punch holder Bushing



Diesel piston pin



Aircraft Plunger Assembly

Your inquiries will have prompt and competent attention

ACCURATE BUSHING COMPANY

425 North Avenue, Garwood, N. J. • Westfield 2-6400



REPRESENTATIVES

BOSTON, MASS.
M. A. Siebert Co.
DAVENPORT, IOWA
Davenport Engineering Corp.
INDIANAPOLIS, IND.
The Standard Die Supply, Inc.
MINNEAPOLIS, MINN.
Chas. W. Stone Co.
BUFFALO, N. Y.
W. S. Gallagher Co.
DAYTON, OHIO
Geo. D. Laughter Co.

DETROIT, MICH.
NEW YORK, N. Y.
Carl Eberhard
PHILADELPHIA, PA.
Albert R. Dorn
CLEVELAND, OHIO
Die Supply Company
DENVER, COLO.
Iver J. Esbenson Co.
HOUSTON, TEXAS
Chickering Tool & Equip't Co.

MILWAUKEE, WISC.
The Stone Company, Inc.
ROCHESTER, N. Y.
Tool & Supply Division
D. J. Andrews, Inc.
RHINEBECK, N. Y.
Frank A. Hart
SOUTH BEND, IND.
Formrite Tool Co.
STRATFORD, CONN.
Ellsworth Steel & Supply Co.
DALLAS, TEXAS
The Stenco Co.

Skepticism Over CMP

Considerable skepticism exists over success of the Controlled Materials Plan, due to go into effect July 1. Because CMP worked well in the last war there is no assurance it will be equally successful when conditions today are wholly different from 1912-5. During that period copper had a uniform price throughout the world, with complete allocation in the U. S. and with our Allies. Today there is no uniformity in price. Even in the U. S. we have a two-way market. NPA can allocate domestic-produced copper but it can't control foreign copper nor can it compel foreign producers to sell their metal to us at our ceiling price. Even today U. S. copper producers are not quoting a fixed price but a price prevailing at date of delivery, thus obtaining any upward revision as soon as it is made.

The effect of higher prices paid abroad for copper, lead, and zinc and the consequent loss to U. S. consumers, is portrayed vividly in the import figures for the first quarter of this year compared to the corresponding period of 1950. For copper, imports were 118,700 tons in the January-March period of 1951, a decline of 39,000 tons from 1950. Lead imports totaled 35,300 tons, compared to 84,700 tons in 1950. Only zinc maintained the same rate, with 98,600 tons in 1951 compared with 96,900 tons in the earlier year.

Read

AUTOMOTIVE INDUSTRIES
Regularly and Thoroughly

SNYDER MACHINES CONTROL COSTS

74 Crankshafts an Hour
at 100% Efficiency

43 Stations
Automatic Transfer

Automatic Operation

Drills all oil passage
and lightening holes



Drills and Reams
manufacturing holes



Automatic positioning



Automatic clamping



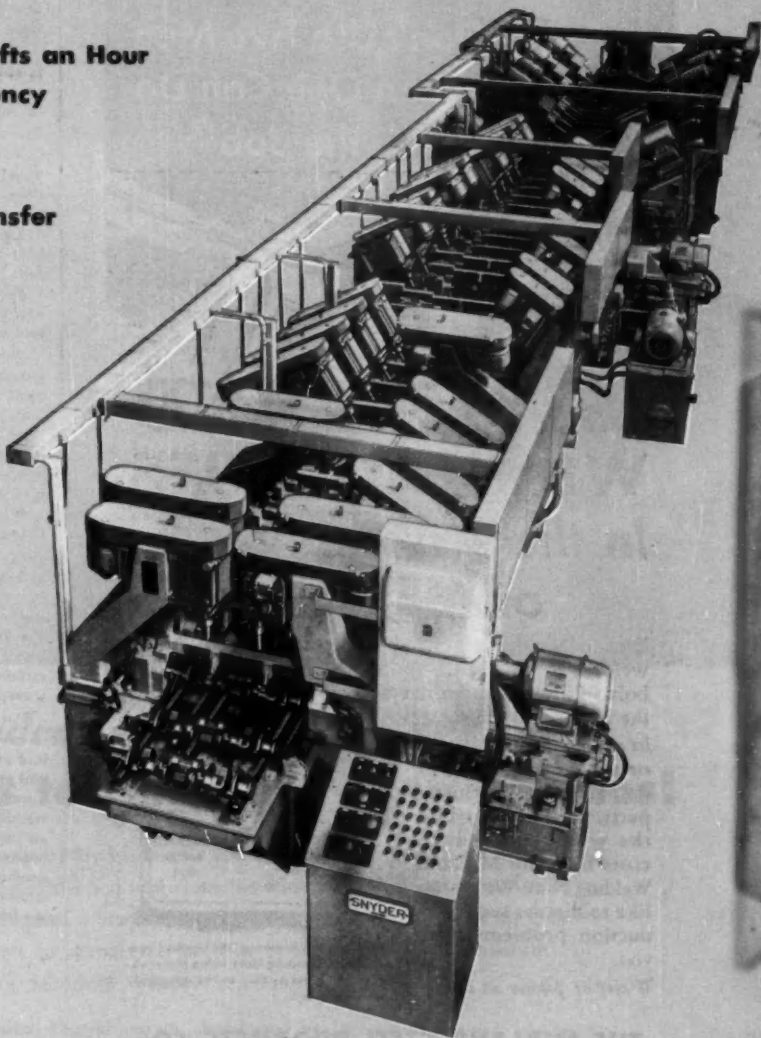
Automatic work cycle



Automatic lubrication



Automatic inspection



SNYDER

3400
E. LAFAYETTE

TOOL & ENGINEERING COMPANY

★
DETROIT 7,
MICHIGAN

26 Years of Successful Cooperation with Leading American Industries

Make the MOST of MANPOWER!



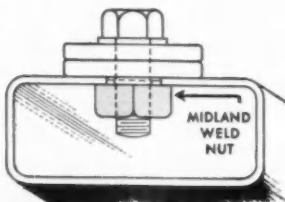
Don't Use Two Men
When One Can Do
the Job!

Use MIDLAND WELDING NUTS In the Assembly of METAL PARTS

Especially valuable in "blind spots," Midland Nuts, welded in concealed spots, make it easy to turn a bolt securely without needing an extra man to hold the nut from turning.

In all places where hands or tools can't reach, in the assembly of metal parts, you can speed up the work and reduce costs by using Midland Welding Nuts. We would like to discuss such production problems with you.

Write or phone us today.



The above drawing illustrates how Midland Welding Nuts solve the problem of "blind spots" in the assembly of metal parts.

THE MIDLAND STEEL PRODUCTS CO.

6660 Mt. Elliott Avenue • Detroit 11, Mich.

Export Department: 38 Pearl St., New York, N. Y.

World's Largest Manufacturer of
AUTOMOBILE and TRUCK FRAMES



Air and Vacuum
POWER BRAKES



Air and
Electro-Pneumatic
DOOR CONTROLS



Upholstery

(Continued from page 33)

on chainstitch machines which run at full speed on hemming operations. Nylon thread is used on lockstitch headline machines for light stitching operations and cotton for heavier work.

Cloth for the back of the front seat is chainstitched on a 300W machine to an asphaltum board stiffener which is inserted in a metal frame to eliminate tacking or stapling.

Medium weight cloth used on door paneling is lockstitched on asphaltum fibre board risers using a 144W machine with either a 30 or a 20-in. arm and a walking presser foot. Art leather kick plates at the bottom of the door panel also are stitched on a 144W using a diamond point needle with a small eye and cotton thread. Each machine uses two needles a week.

Chrome trim is pressed into the door assembly and secured by prongs to cover the blind stitching where materials of different colors are joined. Package trays of asphaltum fibre board are covered with art leather and chainstitched on a 300W machine using an alternating presser foot.

Wind hose made of cloth covered extruded rubber is hand-laid, ten at a time, in a V-shaped trough and cut by a fixed rotary knife. This hand-laying operation is preferred to continuous mechanical cutting because it prevents the rubber from stretching while it is being cut. A retainer wire is lockstitched on an 11W machine to the woven covering on the wind hose.

For sun visors, white cotton wadding is used because it is fluffier. Cloth is laid over the wadding, then lockstitched and trimmed around the hard-tempered fibreboard foundation. A soft cotton wadded edge, bound with art leather—an important safety feature in GM upholstery—is lockstitched on an 11W machine. Sun visor tabs are lockstitched on a 108W machine using a needle feed and walking foot.

Edison Institute Given King Engine Collection

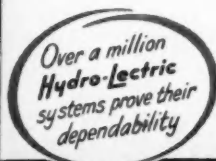
Charles B. King, pioneer in the automobile industry, has donated a collection of 49 accurately scaled miniature engine models to the Edison Institute in Greenfield Village in Dearborn, Mich. The exhibit illustrates the development of power through the successive stages of steam, electric, and internal combustion engines. The largest section of the exhibit consists of steam engine models, beginning with the early Watt and walking beam types. All can be activated by compressed air for demonstration purposes.



***Hydro-Lectric* Window Lifts Are Built to Operate 100,000 Times!**

Laboratory tests of Hydro-Lectric automatic window regulators prove that a car owner could open and close his windows ten times a day for over 27 years—a total of more than 100,000 times. This, of course, is far greater than required in actual service. But it indicates the dependability of Hydro-Lectric automatic window regulators.

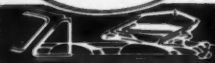
The Hydro-Lectric system, developed by Detroit Harvester, has been selected by leading motor car manufacturers for twelve years. It is the only automatic regulator proved by use in hundreds of thousands of cars.



DETROIT HARVESTER COMPANY

EXECUTIVE OFFICES: 2550 GUARDIAN BUILDING, DETROIT, MICHIGAN

PLANTS: • DETROIT • YPSILANTI • TOLEDO • ZANESVILLE



Convertible
Tops



Hydro-Lectric
Systems



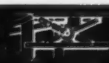
Power
Mowers



Side Delivery
Rakes



Power
Sweepers



Window Channels and
Regulator Assemblies



Automotive
Hardware



Power
Take-Offs



Contract
Production Pumps

Portable Countersink Tool

(Continued from page 56)

face. Operator fatigue was high, and workmen had to be alternated throughout the day.

With the new Auto-Sink tool, Boeing officials say a 1/2-in. hole in 75ST aluminum alloy can be countersunk in 30 to 40 sec. There is such a small expenditure of effort on the part of the operator that he can use the tool a full working day without relief and without more than normal working fatigue.

A contract has been signed under

which the Buckeye Tools Corp., Dayton, Ohio, is licensed exclusively to manufacture and sell the device.

Compact Electronic Computer

(Continued from page 56)

principal moving part — a spinning magnetic drum "memory."

In operation, electronic signals record numbers on the spinning drum which can store about 10,000 digits, and can find and use any of the stored numbers in less than a second. Answers are

arrived at through a differential equation method adapted from calculus. Use of this method is claimed to permit use of a less bulky machine and to enable the calculator to arrive at its answers more quickly. Accuracy is one part in 100,000,000.

The first production model was built by Northrop for the experimental towing tank of the Stevens Institute of Technology in Hoboken, N. J. It will be used by the Institute in predicting the best designs for ship hulls, and for stability and control investigations on hydrodynamic bodies such as torpedoes, underwater rockets, submarines, ships, PT-boats, and flying boats. The Navy Department's Bureau of Ordnance, Bureau of Ships, Bureau of Aeronautics, and Office of Naval Research are supporting and taking an active part in the work being done at Stevens Institute of Technology at the experimental towing tank. Use of the new Maddida in this program is under Navy sponsorship.

BALLS FOR BEARINGS AND OTHER BALL APPLICATIONS



Precision balls made for your job — available in a variety of materials. Your specifications will receive prompt attention in our Engineering Department. We are thoroughly experienced in supplying the automotive industry with special bearings, retainers and balls. Let us give you our recommendations.

THE HARTFORD STEEL BALL CO. HARTFORD 6, CONN.

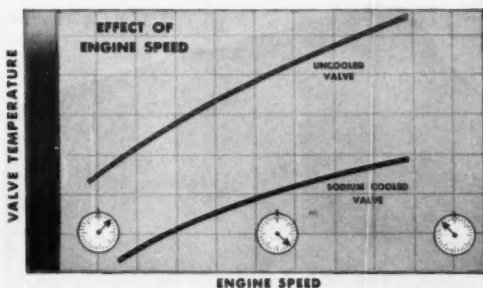
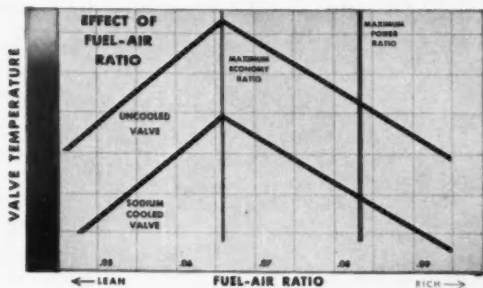
DETROIT: W. S. TOSNER, 455 NEW CENTER BLVD.
CHICAGO: VICTOR H. CLARK, 605 W. WASHINGTON BLVD.
NEWARK, N. J.: GUARANTEED TRUST BROS., 972 BRAD ST.
LOS ANGELES, CAL.: E. B. WALTER CO., 1719 SOUTH FLOWER ST.
EXPORT: R. A. RODRIGUEZ, INC., 35 W. 42ND ST., NEW YORK

CALENDAR

OF COMING SHOWS AND MEETINGS

Conventions and Meetings

- Truck-Trailer Mfr's Ass'n (general membership meeting).....July 13-14
 - SAE National West Coast Meeting, Seattle, Wash.Aug. 13-15
 - First European Machine Tool Exhibition, ParisSept. 1-10
 - SAE Tractor and Production Forum, Milwaukee, Wis.Sept. 10-13
 - Sixth National Instrument Conference and Exhibit, Houston, Texas Sept. 10-14
 - American Society of Mechanical Engineers (fall meeting) Minneapolis, Minn.Sept. 25-28
 - Natl Metal Trades Assn., Chicago, Ill.Sept. 26-28
 - Sixth Annual Industrial Packaging and Materials Handling Exposition, Cleveland, OhioOct. 1-4
 - SAE National Aeronautic, Production Forum, and Display, Biltmore Hotel, Los Angeles, Calif.Oct. 3-6
 - National Metal Congress and Exposition, Detroit, Mich.Oct. 15-19
 - SAE National Diesel Engine Meeting, Drake Hotel, Chicago, Ill.Oct. 29-30
 - SAE National Transportation Meeting, Knickerbocker Hotel, Chicago, Ill.Oct. 29-31
 - SAE National Fuels and Lubricants Meeting, Drake Hotel, Chicago, Ill.Oct. 31-Nov. 1
 - American Petroleum Institute (31st Annual Meeting), Chicago, Ill. Nov. 5-8
 - American Society of Mechanical Engineers (annual meeting)Nov. 25-30
 - Ninth Annual Pittsburgh Diffraction ConferenceNov. 29-30
 - Motor and Equipment Wholesalers Ass'n. (Annual Convention) Chicago, Ill.Dec. 5, 6, 7
- 1952
- SAE Annual Meeting, Detroit, Mich.Jan. 14-18
 - Society of Plastics Engineers, Inc. (eight annual technical conference) Chicago, Ill.Jan. 16-18
 - Pacific Automotive Show, Los Angeles, Calif.Feb. 28-Mar. 2
 - American Society for Testing Materials (annual meeting) New York CityJune 25-27



The Effectiveness of Sodium Cooling for Commercial Vehicles

In considering factors which influence exhaust valve life, temperature is the dominant one. High temperatures sharply reduce the resistance to corrosion, distortion, and fatigue life of the finest alloy steel. The effectiveness of sodium cooling in reducing valve temperatures is shown by the curves above, typical of recorded test data.

The curve "Effect of Fuel-Air Ratio" shows that as the mixture is leaned out to obtain maximum economy, valve temperatures rise. The curve showing "Effect of Engine Speed" indicates that temperature rises rapidly as speed increases.

EATON

Eaton engineers will welcome an opportunity to discuss the application of Eaton sodium cooled valves to engines proposed or now in design.

EATON MANUFACTURING COMPANY

CLEVELAND, OHIO

VALVE DIVISION: 9771 FRENCH ROAD • DETROIT 13, MICHIGAN



PRODUCTS: Sodium Cooled, Poppet, and Free Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater-Defroster Units • Snap Rings • Springtites • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers



Life-Linestarter
PAIRED FOR PRODUCTION
Life-Line motor



STOP costly down time with this pair

"Down-time minutes" can mean a loss of hundreds of units or thousands of dollars. Here's a production team—the best defense against down time—Life-Line motors and Life-Linestarters®. They're paired for production.

Advanced design of these two has eliminated common troubles. Look at the features that make it possible:

Life-Line motor

Steel frame... adds strength, cuts weight.

Pre-lubricated bearings... no greasing.

Improved windings... protected by tough

Thermoset varnish, add electrical life.

Life-Linestarter

Bimetallic disc... calibration unaffected by aging or oxidation.

Servicing is simple... all parts front removable.

Screw driver only tool required.

Get these two dependable performers—paired for production—and stop costly down time. For complete information, ask your Westinghouse representative for "Life-Line Motor Book", B-3842 and "Tomorrow's Starter Today", B-4677, or write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-21639

YOU CAN BE SURE... IF IT'S
Westinghouse

Life-Line

MOTORS and CONTROLS



"Standard"

Serves Manufacturers Who Use
All Shapes and Sizes of
MECHANICAL STEEL TUBING

SIZE AND THICKNESS CHART of Electric Weld Tubing for Mechanical Use

TUBE DIAMETER "O.D. SIZE"	MAXIMUM WALL		MINIMUM WALL	
	DECIMAL	S. W. GAUGE	DECIMAL	S. W. GAUGE
1/2"	.065"	16	.028"	22
5/8"	.065"	16	.028"	22
3/4"	.065"	16	.028"	22
7/8"	.083"	14	.028"	22
1"	.083"	14	.028"	22
1 1/8"	.109"	12	.028"	22
1 1/4"	.109"	12	.028"	22
1 3/8"	.134"	10	.028"	22
1 1/2"	.134"	10	.028"	22
1 5/8"	.148"	9	.035"	20
1 3/4"	.148"	9	.035"	20
1 7/8"	.165"	8	.035"	20
2"	.165"	8	.035"	20
2 1/4"	.180"	7	.035"	20
2 1/2"	.203"	6	.035"	20
2 3/4"	.203"	6	.035"	20
3"	.220"	5	.049"	18
3 1/4"	.238"	4	.049"	18
3 1/2"	.238"	4	.049"	18
3 3/4"	.238"	4	.049"	18
3 7/8"	.238"	4	.049"	18
4"	.250"	3	.065"	16
4 1/4"	.250"	3	.065"	16
4 1/2"	.250"	3	.065"	16
4 3/4"	.250"	3	.065"	16
5"	.250"	3	.065"	16
5 1/2"	.250"	3	.065"	16
6"	.250"	3	.065"	16

Intermediate sizes within the range indicated can also be manufactured. Please consult us for sizes not listed.



Manufacturers requiring tubing for their products are advised to specify "Standard" Electric Weld Steel Tubing for every reason. "Standard" Electric Weld Steel Tubing is produced in one of the most versatile and complete mills of its kind in the world. "Standard" 25 years of specialized tubing "know-how" is available to you.

"Standard" Electric Weld Steel Tubing is produced in one of the most versatile and complete mills of its kind in the world. "Standard" 25 years of specialized tubing "know-how" is available to you.

STAINLESS STEEL TUBING
1/2" to 6" O.D. . . . 20 to 200 wall

ABOVE CHART COVERS
ROUND CARBON STEEL
TUBING . . .

EQUIVALENT SQUARES,
RECTANGULARS AND
SPECIAL SHAPES ARE
ALSO AVAILABLE.

THE STANDARD TUBE CO.

Detroit, Michigan

Welded Tubing Fabricated Parts

STANDARD ——— STANDARD ———

Jet Engine Inducers

(Continued from page 55)

machine shop for additional precision-boring, milling, drilling, etc. Then it is given a Zygo inspection and proceeds through a variety of detail polishing operations. T-P recently introduced a mechanical belt polishing machine for polishing the front and back faces of the blades. However, extensive hand polishing still remains to be done in order to provide an overall finish of the order of 32 microinches.

An interesting feature of polishing operations is found in the provision of Stellite-faced guides on the polishing jacks. These guides define the upper limit to which a given surface may be cut, thus preventing the hazard of undercutting and spoiling an expensive workpiece. Guides are used on all hand polishing jacks as well as on the belt machine.

After polishing, the inducer is ready for final balance, this being done in a Gisholt Dynetric balancing machine. At this point, however, the arbor is nicely balanced so as not to affect the balance of the work. Final balance is held to 0.050 oz in.

A short description of this kind necessarily makes for oversimplification of what is actually an extremely critical manufacturing problem. For example, the vanes are subjected to a series of automatic stages of metal removal and milling of curvature. They are hollow-milled, rough-milled front and back, finish-milled front and back, and have the radius milled on the entry edge. In addition, the vane tip is form-milled on both sides. Later on, Cincinnati mills are used for milling the entry edge radius at the tip section and hub section.





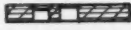



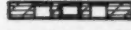

The blade tip is specified to be held within 0.005 in. of true position,—measured with a straight edge from a reference hole in the hub. Similarly, the reamed bolt holes from which true blade position is measured are held within 0.002 in. on diameter and in spacing from one hole to the other. The hub bore, subject to repeated boring operations following sequences of severe metal removal, is held in final size to 4.2595—4.2605.

Final operation is Vapor-Blast treatment, in a special cabinet, to produce a uniform overall surface finish and to remove scratches in the surface from hand polishing and burring.

AUTOMOTIVE INDUSTRIES
Keeps You Informed

AUTOMOTIVE INDUSTRIES, July 1, 1951

Bodine CASE HISTORY NO. 29

- 1 
Hand load to dial feature.
- 2 
".216" (.242 dia.) drill thru.
- 3 
C'sink top 1/64 x 45°.
- 4 
.216 dia. drill thru.
- 5 
C'sink .216 hole—top.
- 6 
.216 dia. drill thru.
- 7 
C'sink .216 hole—top.
- 8 
C'sink .242 hole—bottom.
- 9 
Ream .242 hole to .250.
- 10 
C'sink 2 - .216 holes—bottom—multiple fd.
Automatically eject.

TOOLED TO PROCESS BAKELITE BONDED GEAR BLANKS

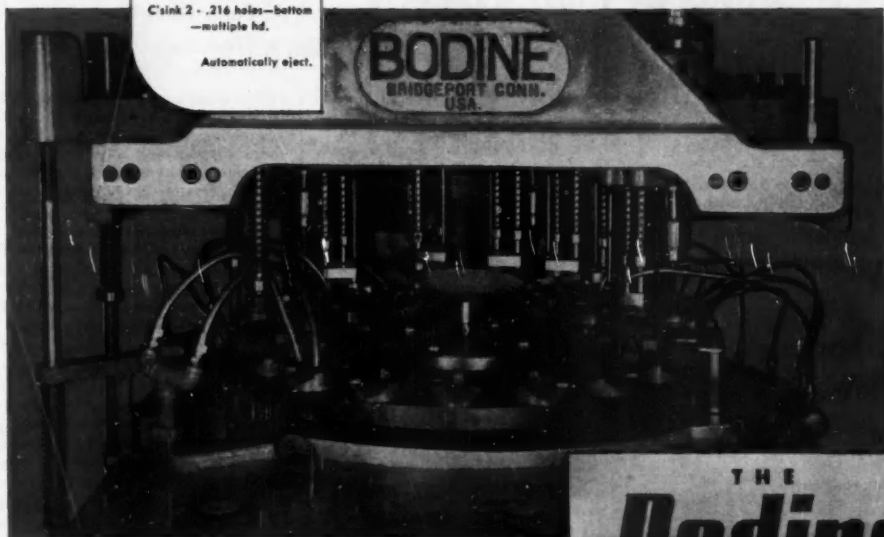


PRODUCTION: The Bodine 42-30 Dial Type Automatic Drilling Machine (one of 6 standard sizes) is equipped with 10 drilling spindles. Production is 20 pieces (or 200 operations) per minute.

ACCURACY: Center hole held concentric with O.D. within .004" T.I.R. Position of two .216" Dia. holes held to tolerance of $\pm .001$ ". Size of center hole held to $.250 \pm .0005$ ".

This is another example of accurate drilling and countersinking at high speeds...the reason why users of Bodine machines have little worry from competition in repetitive production jobs.

Drilling, Milling, Tapping, Screw Inserting, Staking and Assembly may be performed singly, grouped, or all in one machine. Send part or blueprints for recommendations.



"You Can't Meet Tomorrow's Competition
With Yesterday's Machine Tools."



LPG as a Motor Fuel

(Continued from page 49)

upward trend which was very little affected by World War II. In terms of refinery yields, the most pronounced effect of the war was a substantial increase in residual fuel oil at the expense of gasoline. Yields of gas and distillate oils, and of kerosene, were not much affected. However, from the viewpoint of consumption, there were considerable diversions of product to military demands. During the peak years the total production of gasoline and

liquid petroleum fuels was about 4,300,000 bbl per day. The increased military demands amounted to about 1,050,000 bbl per day, of which almost 700,000 bbl per day came out of the gasoline production.

In contemplating a future emergency, one can expect drafts by the military greater in proportion than in World War II—with civilian gasoline providing much of the increase. The widespread use of LPG as a direct

motor fuel could help substantially to alleviate this situation, at the same time materially reducing the requirements for crude oil. Judging by the record to date, this method of augmenting our liquid-fuel supplies would be far less costly in critical materials, manpower, and money than synthetic fuels from coal and shale. From these considerations, it seems self-evident that the acceleration of production, transportation, and marketing facilities for LPG should be a definite part of the mobilization program of the petroleum industry.

Engine Development

It is of great importance to the use of LPG as a direct motor fuel that engine-equipment combinations be designed to use the fuel as efficiently as possible. This can be illustrated by stating that, if the inefficiency is great enough to cause an unnecessary center-gallon reduction in price, it would amount to more than \$30,000,000 per year at a consumption level of 200,000 bbl per day. With respect to engines, fuels, and lubricants, the refining branch is the chief representative of the entire petroleum industry in most of its relationships with the automotive industries. In this capacity, the adequate design of LPG engines and equipment should become increasingly important.

Big Market Ahead for LPG In Farm Equipment

By Ernest Fannin, President,

Fannin's Gas and Equipment Co.

THE trend toward conversion of farm tractors from gasoline to LPG is gratifying because it is in this field, more than in any other type of farm equipment, that we may reasonably expect to develop the largest increase in LPG distribution.

It is conservatively estimated that there are approximately 4,000,000 farm tractors in use in the United States. Depending upon acreage farmed, cultivating season, and horsepower of the tractors, we know that the average fuel used per year varies from less than 1000 gal to more than 4000 gal per tractor. Generally speaking, this usage is confined to the spring, summer, and fall months when the business is particularly acceptable to LPG operators and refineries. By applying simple multiplication, we arrive at a sizable figure measured in terms of gallons of product, whether it be gasoline, Diesel fuel, or LPG.

In comparison with the total number of farm tractors now in operation, those powered by LPG represent a distinct minority because of the relative newness of the fuel, the investment required, and a very natural reluctance on the part of farmers to adopt the fuel



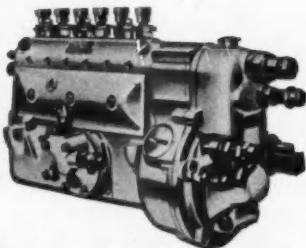
Confidence Abroad



Transport operators all over the world have learnt to trust this sign.

In any language the letters on the C.A.V. sign stand for first-rate service facilities, maintained by highly-trained craftsmen, using special precision equipment.

Wherever vehicles fitted with C.A.V. Fuel Injection Equipment are exported—whether to Trondheim, Santiago, Hong-Kong or Sydney—there's a service agent or depot to give it the specialist attention needed for such high-precision equipment.



Fuel Injection and Electrical Equipment

Service Depots throughout the World

C.A.V. DIVISION OF LUCAS ELECTRICAL SERVICES INC., NEW YORK 19, N.Y. Sales Office: 14820 DETROIT AVE., CLEVELAND 7, OHIO

174-344B



**New
Low Price!**

**New Design
Features!**

Spicer Brown-Lipe Model AA Power Take-Off and Spicer 1000 Series P.T.O. Joints

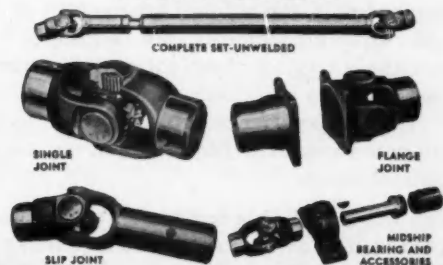
The new Model AA Spicer Brown-Lipe Power Take-Off gives you all the advantages of famous Spicer engineering, Spicer precision manufacturing, and Spicer quality — plus an attractive popular price! Here are the outstanding features:

High Efficiency and Long Life • Needle Bearings • Spur or Helical Alloy Steel Gears • Cable or Lever Control • Easily Installed • No Adaptors or Filler Blocks Needed for Helical Models.

The new Spicer 1000 Series P.T.O. Joint is a fitting quality companion for the new Model AA Power Take-Off. It is a small compact needle-bearing unit, ruggedly constructed, with high capacity. Designed for both continuous and intermittent service. Other special Spicer features include patented blowout-proof oil seal, lubrication fitting, small diameter and wide angle. Can be installed in limited operating space.

Only Spicer offers a complete Power Take-Off and P.T.O. Joint line to meet every need — ask for Spicer engineering help.

and Spicer 1000 Series P.T.O. Joints



TRANSMISSIONS • CLUTCHES • PARISH
FRAMES • SPICER "BROWN-LIPE" GEAR BOXES
PROPELLER SHAFTS • STAMPINGS • FORGINGS
TORQUE CONVERTERS • PASSENGER CAR
AXLES • UNIVERSAL JOINTS • RAILWAY
GENERATOR DRIVES • POWER TAKE-OFFS

Spicer-Built
Brown-Lipe
POWER TAKE-OFFS

SPICER MANUFACTURING
Division of Dana Corporation
TOLEDO 1, OHIO

ALUMINUM CASTINGS

for your
**DEFENSE
ORDERS**

- Sand or Permanent Mold Castings
- Chemical and Physical Laboratory Control
- Heat Treat Facilities
- Air Force Certification

DOUBLE **AA** BRAND ALUMINUM CASTINGS

If you are looking for a proven source of precision aluminum castings—either sand or permanent mold—you'll find the answer at Aluminum Alloys Corporation. Our large, modern plant provides you with the facilities and capacity for volume production of aluminum castings. Our laboratories are equipped and staffed to accurately control chemical and physical quality to the most exacting standards. Add to these factors more than 20 years' experience casting aluminum exclusively, and you have a combination you can rely on for defense contract needs.

Why not investigate today . . . your inquiry will receive prompt attention. *Aluminum Alloys Corporation, Walton at West Warren, Detroit 10, Michigan.*

ALUMINUM ALLOYS

Corporation

RAY DAY PISTONS SINCE 1925

until they are convinced that its application will result in more satisfactory tractor operation at lower cost.

As yet we have barely scratched the surface. It means that there still is plenty of business to be had, and that a major portion of it should develop during the months when we need it to balance our summer-winter operation.

In the absence of actual tabulations, which obviously are not readily obtainable, but based upon reports and careful observation, we can safely say that during the year 1950 more than 100,000 farm tractors already in use were converted from gasoline to LPG.

Again we are talking in large figures; but actually, when we slide-rule the percentage, our potential market is glaringly apparent. Probably the 1950 figure will be much increased—perhaps doubled—in 1951 if there is not too much lag in production because of world conditions.

Publications Available

(Continued from page 64)

D-11 Conveyors

Link-Belt Co.—A new pamphlet gives complete design details and specifications of Flexmount oscillating conveyors. Dimensional drawings are provided.

D-12 Machine Tools

The Cincinnati Milling Machine Co., and Cincinnati Grinders, Inc.—Publication M-1712 describes and illustrates milling machines, milling and die sinking machines, milling machine attachments, broaching machines, grinding machines of various types, grinding machine attachments and the Flamatic hardening unit. Specifications are provided.

D-13 Diesel Engines

Caterpillar Tractor Co.—A booklet, Form 30160, features the new six-cyl supercharged DW20 and DW21 Diesel engine. It points out the fuel injection system developed by the firm and includes design and performance data on the 225 hp engine.

D-14 Rivets

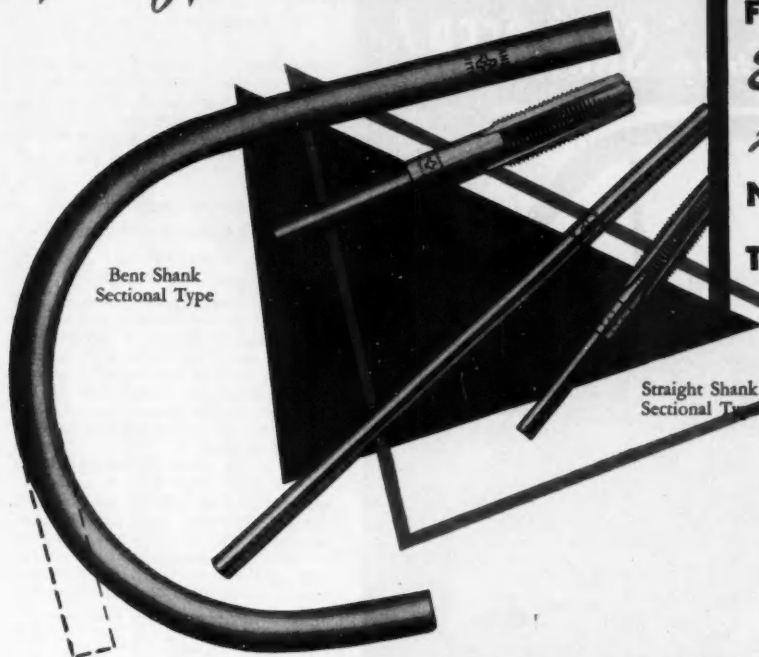
Cherry Rivet Co.—Catalog C51 contains eight pages which give in detail the applications, descriptions, and specifications of standard Cherry blind rivets and Cherry rivet guns.

D-15 Aircraft Hose Assemblies

The Weatherhead Co.—Latest technical information on aircraft flareless, AN tube fittings and flexible hose assemblies has been compiled in a new six-page brochure, A-300.

Specify **Hanson-Whitney TAPPER TAPS**

**FOR
Economic
Automatic
NUT
TAPPING**



While one piece Tapper Taps . . . both straight and bent shanks . . . are available in standard and special sizes, we recommend the sectional type shown. Used with automatic tapping machines, they are most economical, as the nibs, soldered into shank, can be readily replaced when worn beyond further use. Shanks seldom require replacement.

Sectional type tapper taps are furnished in standard NC and NF series from $\frac{1}{4}$ " to $\frac{3}{4}$ " diameter. Intermediate sizes and other thread forms are special. As there are several types of automatic tappers, the name and size of your machine must be given. Shank designs furnished as follows: BENT SHANK — hook or right angle design as illustrated. STRAIGHT SHANK — round, square, Acme Improved Type "C," or National Interchangeable Ring Lock.

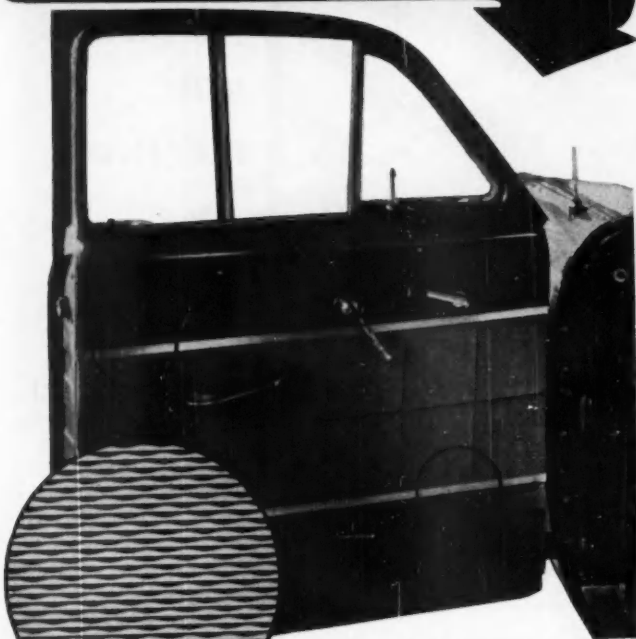
Hanson-Whitney taps are finished after hardening on machines of our own design for Quality Control. For more tapped holes per grind and lower cost per piece, specify the H-W line.

HANSON-WHITNEY COMPANY • HARTFORD 2, CONN. • DIVISION OF THE WHITNEY CHAIN COMPANY



©HWS1

Permanent **BEAUTY** *That's*
More Than **SKIN-DEEP!**



Actual size of
Rigidized Metal
pattern 2-WL

with INTERIOR DOOR TRIM made of

Rigidized

DESIGN
STRENGTHENED **Metals**

"Built-to-last" features have special attraction for car buyers today. RIGIDIZED METALS give you door trim beauty that won't scratch off, are strong in modern eye-appeal contributing to new-car glamour. Straight chrome stainless RIGIDIZED METAL interior trim resists scuffs, scratches, and dents. There are RIGIDIZED three dimensional designs for unlimited applications throughout the entire automotive industry. Kickplates, scuffplates, and treadplates are only a few adaptations receiving longer unit-life and added beauty through fabrication with these highly versatile metals. If you wish surface protection, reduced weight with great structural strength and CONSERVATION OF CRITICAL MATERIALS, your most exacting requirements can be filled by three dimensional RIGIDIZED METALS. Don't fail to investigate them now.



Send for your copy of the
Rigidized Metals IDEA Handbook
TODAY

Rigidized Metals Corporation

671 OHIO STREET BUFFALO 3, N.Y.



Military Vehicle Developments

(Continued from page 38)

progressively greater with increasing TEL content. These results suggest that torque loss attributable to combustion-chamber deposits is a more important factor with L-Head engines than with over-head valve engines.

Cummins Experimental High Speed Diesel Engine

By N. M. Reiners, and R. C. Schmidt,
Cummins Engine Co.

FOR the development program, the small size requirement was met by the Production JS engine. It had a 4½ in. bore and 5 in. stroke (401 cu. in.) and was rated at 150 bhp at 2500 rpm. It was given the designation "JSX." This engine surpassed the program objectives, developing 345 bhp at 4000 rpm. It weighed only 840 lbs., and while basically the same in design as the original stock engine there were several outstanding differences. The fuel metering system was experimental. Aluminum was used wherever possible, including the basic engine structures such as the block and head. Even the highly loaded main bearing caps were

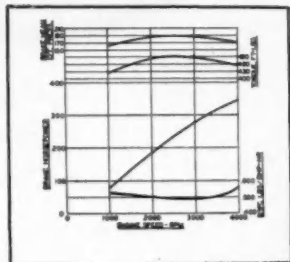


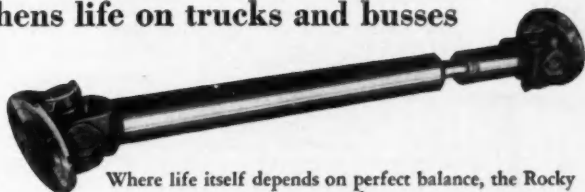
Fig. 3—JSX engine performance curves

aluminum. The air intake manifold was separated from the hot exhaust pipe by moving it to the opposite side of the engine, and the cylinder head had four valves per cylinder instead of two. The small, side-mounted Roots type supercharger, running twice engine speed, was replaced with a larger Roots type blower mounted at the front end of the crankshaft and driven at engine speed through a flexible coupling. This reduced the possibility of drive troubles, but of more importance, operating a larger blower at engine speed assured higher blower efficiency.

Fig. 3 shows the torque, horsepower and fuel consumption curves that were obtained with this high speed engine. At the end of this initial phase of the development, 345 bhp at 4000 rpm was pulled with a clear exhaust. This output included the usual engine accessories. (Turn to page 104, please)



built right for rough going, with fine balance
that lengthens life on trucks and busses



Where life itself depends on perfect balance, the Rocky Mountain Big-horn knows no qualms. From horns to hoofs, he's equipped for the roughest kind of going.

Trucks and busses too, when Blood Brothers equipped, take brutal daily service in their stride. *Built right* to get the power through, the precise balance of Blood Brothers Propeller Shafts assures long life with little vibration and wear.

You may gain important advantages when you call on Blood Brothers — makers of universal joints and drive line assemblies exclusively.

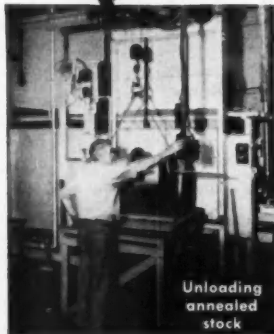
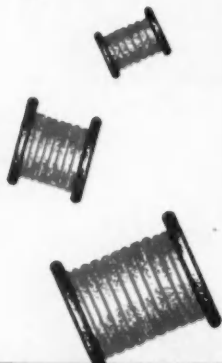
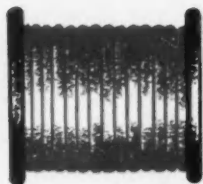


BLOOD BROTHERS machine co. ALLEGAN, MICHIGAN

Division of Standard Steel Spring Company

Chicago Office: Great Lakes Spring Division, 7035 West 65th Street

Bright Annealing of Copper



Unloading
annealed
stock



View
from
charge end

HOLCROFT'S HIGH-PRODUCTION FURNACE MINIMIZES OXIDATION

Typical of Holcroft trail-blazing in furnace engineering, this high-production gas-atmosphere unit handles bright annealing of wire, strip and bar stock of copper and non-ferrous copper alloys. Note these special features:

• Except for loading and unloading, operation is fully automatic. Coiled stock is loaded on trays as shown. Bar stock can be annealed simultaneously in bank of six tubes at top of furnace. Production is 4000 lbs. per hour.

• Special Holcroft gas generator under automatic control provides inert protective atmosphere surrounding work in process. Gas is free of sulfur and oxygen, with negligible hydrogen and CO content. Gas-tight furnace and vestibules plus automatic flushing further assure uncontaminated work.

• Heating is by Holcroft electric elements, quickly replaceable without shutting down furnace. Gas-fired radiant tubes can be used where more economical. Heating zone is held at any desired temperature from 500° to 1150° F. Annealing zone is water-cooled.

• These, plus other Holcroft features, assure maximum economy and quality of work, as proven by four years of continuous operation at Canada Wire and Cable Company. These same production advantages are found in Holcroft furnaces for every heat treat requirement; for each Holcroft furnace is individually designed for its specific application and is backed by complete metallurgical and engineering service.

We cordially invite your inquiries.

BLAZING THE HEAT TREAT TRAIL

SINCE 1916



CHICAGO 9
C. H. Martin, A. A. Engelhardt
4209 South Western Blvd.

6545 SPWORTH BLVD.
CLEVELAND 15
W. Hare F. Schott
1900 Euclid Avenue

HOUSTON 1
R. E. McArdle
5724 Navigation Blvd.

DETROIT 10, MICHIGAN
CANADA
Walker Metal Products, Ltd.
Windsor, Ontario

EUROPE
S. O. F. I. M.
Paris 8, France

PRODUCTION HEAT TREAT FURNACES FOR EVERY PURPOSE

ries, except the fan and generator. The rising torque curve which peaks at mid-speed range is characteristic of the type which is considered good for automotive application. Instead of equaling the 168 bmeq at maximum speed, the engine actually ran at 172 bmeq at 4000 rpm, and increased to 188 at maximum torque. These figures were not taken at maximum possible power, but rather at the limit of good combustion, or you might say, a commercially clean exhaust; the terms are synonymous for practical purposes. The maximum torque fuel consumption which reaches .480 minimum and .560 maximum is considered good for the size, speed and output of the engine. These fuel rates should retain the proven fuel economy of the Diesel.

The curve of friction horsepower vs. engine rpm derived in this manner, is shown by Fig. 4. The curve is exponential, and similar to a cubical equation

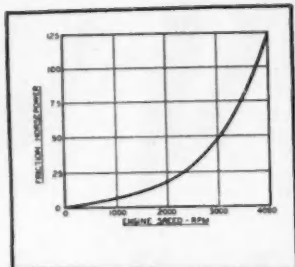


Fig. 4—Friction hp of JSX engine

of some sort; increasing very rapidly at the higher speeds. This suggests that windage and pumping losses are weighty factors at the higher speeds. The 120 friction horsepower reached at 4000 rpm gives a mechanical efficiency of approximately 74 per cent. In our opinion, 74 per cent is on the low side for such a high specific output, but at this stage of the development, it seems to be a fair efficiency for 4000 rpm.

Examination of the character of the friction horsepower curve leads to a very interesting disclosure. The engine developed 333 bhp at 3700 rpm and 345 bhp at 4000 rpm, an increase of 12 bhp. The "indicated horsepower" increased 35, but the friction horsepower had increased 23, which gave the net gain of 12 bhp indicated by the power curve. Extrapolating in this manner beyond 4000 rpm, shows that the brake horsepower would peak around 350, at approximately 4300 rpm. Above 4300, the brake horsepower would become less and less, because of the rapidly increasing friction horsepower. Flash power checks at the higher speeds bore this out, and the rate of diminishing return established the rating 4000 rpm maximum; consequently, 4000 rpm was not exceeded in collecting the data.

(Turn to page 106, please)

Crys Coat

is in Good Company!



*Prepares Metal Surfaces for Painting

*Patented Material and Process

WHEN it comes to answering demands for specialized power equipment, International Harvester has crawler models to fit every need. Each tractor of the IH crawler line is sturdily built for long years of faithful service. Even the paint finish is designed to withstand heavy weather and hard knocks. International Crawler tractors receive the Oakite *Crys Coat* treatment before painting to assure long-lasting paint adhesion; to prevent peeling; to resist corrosion.

The Oakite *Crys Coat* Process may be just what you're looking for. With minimum equipment . . . in minimum time . . . at minimum cost you can (1) clean metal surfaces and condition them for painting; (2) improve the adhesion of paint to metal; (3) prevent corrosion before metal is painted; (4) localize corrosion under paint if finish is broken.

The Oakite *Crys Coat* Process Offers These Extras:

1. Eliminates operations... uses less equipment
2. Cuts operating time
3. Uses less chemicals for cleaning and conditioning
4. Reduces heating costs

5. Saves cost of expensive acid-proof tanks and equipment
6. Saves cost of frequent descaling and desludging
7. Drag-out costs are less because of low original cost of solution
8. Saves paint
9. Cuts cost of rejects caused by rusting before painting

FREE ... illustrated folder describes the Oakite *Crys Coat* Process for use in before-paint-treatment of steel, aluminum sheet and castings, zinc die castings and galvanized surfaces. If you are engaged in the fabrication of civilian goods or the speedy production of defense orders—send for Folder F7642.

OAKITE PRODUCTS, INC., 284 Thomas St., NEW YORK 6, N. Y.
Technical Service Representatives in Principal Cities of U. S. & Canada

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

UNITED SPECIALTIES COMPANY

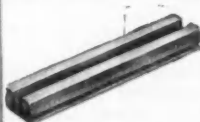
AIR CLEANER HEADQUARTERS for the AUTOMOTIVE INDUSTRY

Throughout the entire range of automotive equipment—from the small power lawn mower to powerful cars and giant diesel crawlers—United offers an oil bath air cleaner to fit the need. Today over 260 United Air Cleaner models are protecting millions of internal combustion engines in every type of operation—passenger cars, busses, tractors, trucks, farm machines, stationary and portable power units.

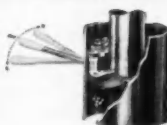
With newly expanded facilities in three modern plants, United Specialties Company is equipped to provide the newest and best in specialized automotive products. These facilities were added to meet increased normal requirements. They can serve you equally well for your special emergency conditions. We invite your inquiry.



Combination oil bath cleaner and silencer designed for use on down draft carburetor where headroom is not available for conventional cleaner and silencer.



Complete range of metal shapes: cold rolled, drawn and pressed.



Concealed-type turn signal switch. Signal is self-cancelling.



Gasoline engines used on tractors, combines and other agricultural implements are protected by this standard type United Oil Bath Air Cleaner.



Conventional-type Mitchell ignition switch used on popular makes of cars and trucks.



Plastic oil bath air cleaner for small engines. Cleaning action visible to user.



Mitchell clamp-on screw-type semi-automatic turn signal switch used in cars, trucks, busses.



This air cleaner protects diesel engines in truck, tractor and industrial power units.



Television picture tube spun metal shell. Available in 16-inch round and 17 and 21-inch rectangular models.

UNITED SPECIALTIES COMPANY
CHICAGO 28 • PHILADELPHIA 36 • BIRMINGHAM 11

The 4-valve cylinder head, with its excellent breathing characteristics, was a major factor in making 4000 rpm operation possible. At one stage in the development, the maximum bhp was developed at 3300 rpm with a 2-valve head. Simply changing to the 4-valve head added 40 bhp at the same speed at equal exhaust smoke limits, and pushed the speed of maximum horsepower output up to approximately 3700 rpm.

It should be emphasized that there are no plans for production of the engine as described in this paper. The program did not produce a saleable engine. Rather, the JSX charted the path for the step by step climb to higher Diesel power and higher specific output. It showed that higher speed Diesel engines can be run with production materials and without gadgets or special devices. It was simple, and although experimental, it was practical in every respect.

Possible Mechanisms by Which Combustion Chamber Deposits Accumulate and Influence Knocks

By L. F. Dumont,
E. I. du Pont de Nemours & Co.

THE increase in surface temperatures as deposits accumulate appears to be the main factor responsible for limiting the quantity of combustion chamber deposits formed in engines. For leaded fuels the temperature gradient across the deposit from the surface to the metal wall and the thermal stresses accompanying this gradient eventually reach a critical value which causes deposit flaking to occur. That deposit surface temperatures increase substantially is indicated by the changes in chemical composition which occur as deposits accumulate.

It is postulated that there are three possible mechanisms by which combustion chamber deposits could increase octane requirement: (a) volume, (b) catalysis, and (c) thermal insulation. On the basis of experiments reported herein, the increase in compression ratio caused by deposit volume accounts for approximately 20 to 40 per cent of engine octane requirement in (Turn to page 108, please)

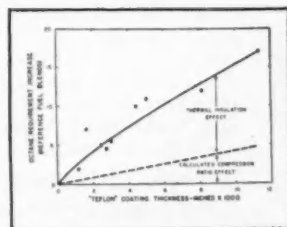


Fig. 5—Effect on octane requirement of catalytically inert, low heat conductivity combustion chamber deposits consisting of Tetlon cylinder head coatings.

Your grandfather rode a Columbia-Built bicycle

today...it's better-than-ever...with
SHELBY SEAMLESS TUBING



IN 1877, Columbia made the first bicycle ever produced in the United States. Within a short time, Columbia-built bicycles became famous throughout the world . . . and they're still famous today, 74 years later.

Columbia bicycles have this high reputation because the manufacturer is quick to adopt new fabricating methods . . . quick to utilize the finest materials for every vital part.

A good example is the use of high strength Shelby Seamless Tubing for the head tube and crank-hanger tube—the two most heavily stressed frame parts. Shelby Tubing is easy to machine accurately, so it simplifies bearing alignment in these critical sections.

It's strong, too. All Shelby Seamless Tubing is pierced from a solid billet of fine steel. This process is one of the most drastic forming operations in the steel business, and nothing but the best steel can withstand such treatment.

Shelby Seamless Tubing has always been famous for uniform wall strength, from one end to the other. It's so strong that many manufacturers have long used it in place of solid bar stock; and, since the basic shape is already made, fewer operations are necessary, rejects go down, production costs can often be cut an appreciable extent.

In planning your future program, let our service engineers help show you how to cut production time and costs with this easy-to-machine, high strength material. Draw upon the priceless experience of National Tube Company—world's largest manufacturer of tubular steel products.

NATIONAL TUBE COMPANY, PITTSBURGH, PA.
(TUBING SPECIALTIES DIVISION)

COLUMBIA STEEL COMPANY, SAN FRANCISCO
PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

National Tube Company
Frick Building, Pittsburgh 19, Pa.

Please send me your free booklet describing mechanical applications of Shelby Seamless Steel Tubing.

Name.....

Company.....

Address.....

City & State.....



Shelby Seamless Steel Tubing

UNITED STATES STEEL

It's easy to learn to treat Molybdenum High Speed Steel



FREE—this
booklet gives
all the facts

Data on performance, heat treatment and other authoritative facts are available in our booklet "Molybdenum High Speed Steels".

More and more high speed steel will be of the Molybdenum types which are already giving performance equal to or better than tungsten steel, with economy in alloy content.

Climax Molybdenum Company
500 Fifth Avenue · New York City

Please send your FREE BOOKLET
"MOLYBDENUM HIGH SPEED STEELS"

Name
Position
Company
Address
AI-7 HS-7

crease, depending on the engine type and type of deposits. These particular experiments indicated that catalysis may not be a contributing factor, especially for leaded fuel deposits, although considerably more work will be required to confirm these results. The thermal insulating effect of deposits appears to be one of the major causes of deposit knocking harm.

Tests conducted in this laboratory with single-cylinder engines have indicated that catalytically inert films of low thermal conductivity increase octane requirement substantially over and above their volume effects. Teflon* was used since it is noncatalytic, a very poor heat conductor, and is also capable of surviving engine operation when it is fused on the combustion chamber walls in thin films. In these tests the coatings were prepared by spraying a dispersion of Teflon in water on the cylinder head. The coating was slowly dried so that a thin continuous film of uniform thickness was formed and was then fused at 750 F with a torch. The effect of the film on the octane requirement of the otherwise clean engine was then determined. Following each test the Teflon film was stripped from the metal and its actual thickness determined. The results of these tests, given in Fig. 5, indicate that the octane requirement increased almost in direct proportion to the thickness of the film. The calculated volume effects of the films on octane requirement were measured and were found to account for only 25 per cent of the total increase in octane requirement observed. The thermal insulating effect of the film, therefore, caused 75 per cent of the octane requirement increase. The fact that an insulating coating only 0.011 inch thick on the cylinder head increased the octane requirement 17 units is highly significant, since the thickness of equilibrium combustion chamber deposits is usually several times greater.

*—du Pont Polytetrafluoroethylene.

Gear Makers Meeting

(Continued from page 52)

ducing the angle of approach and eliminating the trochoidal path of the tip of the entering driven tooth. Tooth strength is thereby increased 50 to 75 per cent. This procedure is more desirable than the modified tip of the steel driven gear tooth which would reduce tooth contact duration and would not remove tendency to interference. When plastic driven gears are considered these modifications are necessary only in the sense of eliminating excessive undercut. In all cases of a steel versus nylon wear surface, the best condition is with a highly polished, hardened steel pinion.



THIS TIME IT'S NACOGDOCHES, TEXAS

Over in the prosperous timber and agricultural belt of east Texas, the city of Nacogdoches is looking and planning for further growth. Needing more water, municipal officials called in Layne and ordered the installation of another deep well and pump unit,—the third since 1925. With this new unit in operation, the city now has a greater supply of water than is presently needed.

These three Layne installations extending back for more than a quarter century, have had every opportunity of failing,—or proving their value in high efficiency, long life and absolute dependability.

Congratulations to Nacogdoches for the continued and exclusive use of the world's finest wells and pumps.

LAYNE & BOWLER, INC.
General Offices, Memphis 8, Tenn.

ALL PURPOSE PUMPS

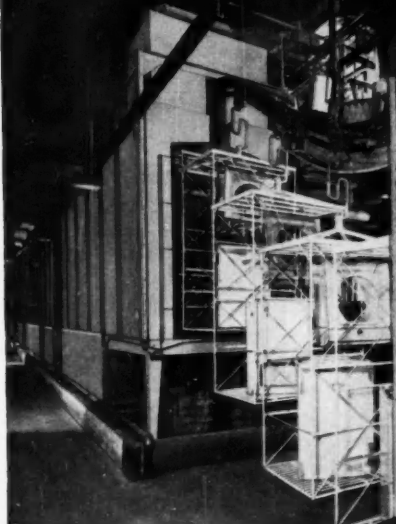
Layne's new catalog on Short Coupled Service Pumps will be sent on request. It fully illustrates the many practical applications of these wonderfully efficient all purpose pumps.

Layne
WATER SUPPLY
WELLS & PUMPS

COMPLETE

SYSTEMS

for ENAMEL • LACQUER • PAINT



Mahon Cleaning and Pickling Machine Installed as Part of a Complete Finishing System for one of the World's Largest Household Appliance Manufacturers.

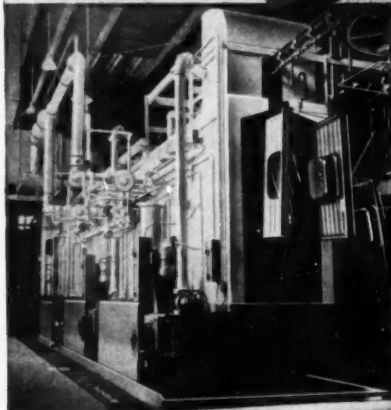


Mahon Cleaning and Pickling Machine with Dry-Off Oven Installed in the Plant of a Leading Electric Range Manufacturer.

... the EXPERIENCE that goes into the PLANNING and ENGINEERING of MAHON EQUIPMENT is the item of GREATEST VALUE to YOU!

CLEANING and PICKLING OPERATIONS Made Simple by Completely Enclosed Continuous Processing Equipment!

New, modern Mahon Cleaning and Pickling Machines have reduced pickling operations to one-third the time formerly required . . . volume of processing solutions has also been drastically reduced. Elaborate ventilating and air replacement systems are no longer necessary with these completely enclosed tunnel-type processing machines. A patented Hydro-Hermetic Seal, running the full length of the machine, prevents the escape of active chemical fumes and permits the use of an overhead monorail conveyor. Manufacturers who are now using these machines in production are loud in their praise of their time-saving effectiveness. Mahon Cleaning and Pickling Machines can be fitted right into your present production system . . . they can be designed to meet any requirement of product processing, production rate, or plant layout. No matter what your finishing equipment requirements may be, you can turn to Mahon with complete confidence . . . remember that Mahon engineers are backed by a wealth of technical knowledge and practical know-how accumulated through thirty years of pioneering development in this highly specialized field. See Mahon's Insert in Sweet's Mechanical Industries File, or write for Catalog A-652.



Mahon Cleaning and Pickling Machine Installed in the Plant of a Manufacturer of Porcelain Enamelled Kitchen Sinks and other Units of Plumbing Ware.

THE R. C. MAHON COMPANY

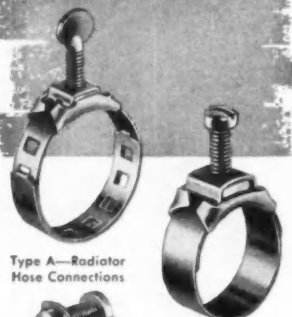
HOME OFFICE and PLANT, Detroit 34, Mich. • WESTERN SALES DIVISION, Chicago 4, Ill.
Engineers and Manufacturers of Complete Finishing Systems—including Metal Cleaning and Pickling Equipment, Metal Cleaning and Rust Proofing Equipment, Dry-Off Ovens, Hydro-Filter Spray Booths, Filtered Air Supply Systems, and Drying and Baking Ovens; Core Ovens, Dust Collecting Systems, Fog-Filters, and many other Units of Special Equipment.

MAHON

WITTEK

NOC-OUT HOSE CLAMPS

*The Standard
of the Automotive
Industry*



Type A—Radiators
Hose Connections



Type HP—High
Pressure Hose
Connections

Type G-BB—Booster
Brake Hose Connections
No. G-B-MH
for Hot Water
Heater Hose

Wittek Noc-Out Hose Clamps are designed in a variety of types made in many sizes for use by the automotive industry. Because they provide the most practical leakproof hose connection, they are specified by the leading manufacturers as standard, original equipment for automobiles, buses, trucks and tractors.

Write for descriptive literature.

Automotive
**HOSE
CLAMPS**

WITTEK

MANUFACTURING CO.

4319 W. 34th Place, Chicago 33, Ill.

Dependability in Hose Clamps
for Over a Quarter of a Century

Universal Joints Production

(Continued from page 44)

of two separate stages, the parts rolling down the chute from the hopper for a takeoff into the first bin. The chute is designed to give each ball a rotary motion as it drops onto the anvil to make sure that most balls will drop on their spherical face. The balls then are picked up by the little flight conveyor, elevated to the second drop station where they roll down the chute onto the second anvil. Only a very small percentage of the balls fails to pass this test and remains in the bins. These balls are gathered at intervals and put through the test machine a second time. This is done to salvage some of the balls, which through chance behavior, may have struck the anvil on edge instead of the spherical surface. The point is that not all failures to pass the test can be attributed to imperfections.

One of the most versatile pieces of equipment in this plant is the Monarch Mono-Matic lathe. At the present writing they have in use four of these tracer-controlled machines and have more on order. Currently the machines are busy on the turning of flanges which, in some cases, require a number of stepped diameters, facing, and formation of fillets. The job is done in a single setting with a solid inserted cemented-carbide tool. As an example of the extremely rapid metal removal made possible by this equipment, one of the flanges is machined with a feed rate of 10 fpm and a spindle speed of 500 rpm.

Certain operations require large batteries of similar machines. For instance there is one line of some 60 Head Size-Matics for internal grinding. A battery of New Britain-Gridley automatics is employed for various parts; and there are three units of the well-known Davis & Thompson Roto-Matics—with two, eight, and 12 spindles respectively.

There is also a large battery of special horizontal, trunnion type machines built by Krueger for machining spiders.

Precision operations abound, one interesting example being the finishing of trunnion pins. The final operation takes place in a small battery of machines consisting of two Landis centerless grinders, a Cincinnati centerless, and a Feed-matic attachment at the head of the line for feeding parts one-by-one into the grinders. Pins require two passes through the two Landis grinders for OD finishing, one pass through the Cincinnati for chamfering the ends. It is of interest that OD is held to plus or minus 0.00015 in. while surface finish is specified at 10 micro-inches, maximum. The entire operation is fully automatic, the machines being connected by a slide conveyor.

Flanged bushings for joints have the

(Turn to page 112, please)



Know at ALL Times ACTUAL SALES, BASED ON OFFICIAL REGISTRATION RECORDS

Know how many new cars are being sold each month—where and when. Use facts to determine sales quotas, to gauge service potentials, to plan profitable manufacturing programs.

Link Sales and Production Through Basic Statistics

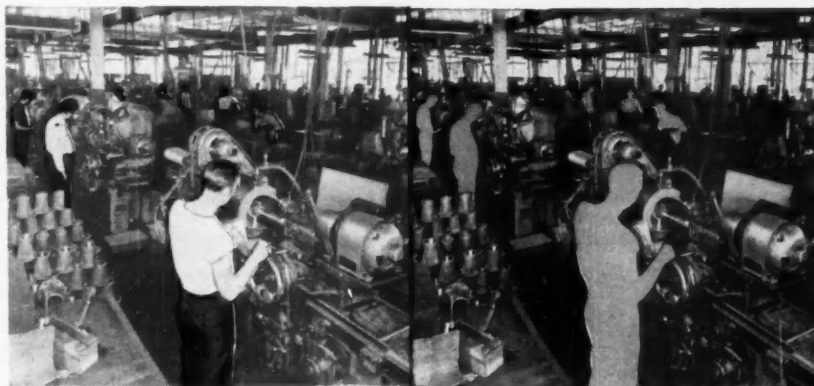
Write, wire or phone for details on this comprehensive, expanded service.

R. L. POLK & CO.

MOTOR STATISTICAL DIVISION

431 HOWARD STREET
DETROIT 31, MICHIGAN

the SKILL the FACILITIES



... to deliver **TRUE PRECISION**
in Parts Such As These

When many of the country's largest and most prominent manufacturers require hardened and precision ground parts that must adhere rigidly to quality specifications and meet every precision requirement, they rely on Allied to produce them. They know that, no matter how difficult or in how high a volume the parts may be ... regardless of the number of operations involved ... Allied has the personnel and equipment to do the job right, economically and on time.



Other ALLIED PRODUCTS

SPECIAL COLD FORGED PARTS
STANDARD CAP SCREWS • SHEET
METAL DIES FROM THE LARGEST
TO THE SMALLEST • ALLITE ZINC
ALLOY DIES • JIGS • FIXTURES
R-B INTERCHANGEABLE PUNCHES
AND DIES



ALLIED PRODUCTS CORPORATION

DEPT. D-1 • 12645 BURT ROAD • DETROIT 23, MICH.



PLANT 1
Detroit, Mich.



PLANT 2
Detroit, Mich.



PLANT 3
Hillsdale, Mich.



PLANT 4
Hillsdale, Mich.

internal bore and thrust face hardened to a standard pattern in a Tocco internal induction hardening machine. Work is fed to the hardening head on a small pusher type conveyor and is ejected automatically at the completion of the cycle, being picked up on a small flight conveyor which transports the parts to the grinding operation.

The company has had signal success with the Cridan threader made by Lees-Bradner. An exceptionally high speed machine using a single-point cemented-carbide tool, it produces fine interchangeable threads by a rapidly repeating cycle. At present several of these machines are being set up for a special

project—one for threading an aluminum nose piece, the other for cutting an internal thread in a large steel member. On the aluminum job, the smaller machine has a spindle speed of 2000 rpm.

The tube mill—housed in a separate structure—deserves special mention since it is responsible for producing all of the many miles of tubing used here. Major interest is in the large Yoder tube mill which forms tubing from selected steel strip made in accordance with special analyses and close tolerances in cold rolling. The strip is shaped into a tube by a series of forming rolls and welded at the seam by

the electric resistance welding method at the welding station in the center of the tube mill. Tubing is produced in 25-ft lengths or multiples at a rate of about 75 fpm, ranges in diameter from two to four in. in a corresponding range of gages.

Supplementing the Yoder tube mill is a group of two cut-off machines which cut the long lengths into standard lengths required for individual propeller shafts. Following cut-off, the tubes are fed into a special W. F. & John Barnes machine in which the ends are faced and chamfered.

Some of the propeller shafts require necked ends and to meet this requirement the company recently installed a special horizontal swaging machine built to order by Williams-White. It is arranged to handle the full variety of parts design and has automatic cycling.

Since swaging is an extreme form of drawing, the tube end must be fully annealed to assure formability without cracking. To this end they have just installed a Tocco induction heating machine, arranged with a suitable coil for heating the tube end to be swaged.

Yoke ends are welded to tubing to produce propeller shafts and the company has a large battery of special arc welding machines with automatic cycle for this purpose. It is of interest that the generators for these machines are all located below the floor to promote best electrical operating conditions. The equipment produces a dense, sound weld which requires no further finishing.

Materials handling plays an important part in the plant. The company operates a large fleet of industrial trucks of various types, including tiering trucks for handling pallets of finished propeller shafts. Although the operation does not lend itself economically to the general use of monorail conveyors, gravity roller conveyors are employed extensively for assembly and for movement along machine lines.

One of the most interesting conveyor systems found here is the one for final assembly. As illustrated, it is composed of several different sections, with automatic transfer from one section to another. Skillful break-down of assembly functions, coupled with proper sequence of individual steps makes it possible to operate this line at a rate of approximately 700 assemblies an hour.

Books . . .

THE BEHAVIOR OF ENGINEERING MATERIALS by H. W. Gillett, published by John Wiley & Sons. Specifically, the text is designed for the use of purchasing agents, engineers, designers, and others who must deal intimately with materials of all kinds and should be capable of cooperative effort with their metallurgists. The first group of chapters serve to introduce some of the basic concepts of the metallurgical art. The remaining chapters take up the behavior of each of the principal commercial metals and alloys as well as the special considerations that may influence their selection. Covering both ferrous and non-ferrous materials, the book touches on castings, plating, metal films, powders, bearing metals, problems of wear and corrosion. Besides being a textbook, it should prove of value as a handbook for ready reference.

Highest Precision

HARDENED & GROUND PARTS

THE ball stud shown here is a perfect example of the precision methods and quality material that go into the production of all Brown Hardened and Ground Parts. Twelve separate operations are employed to produce this vital part. Every feature about this ball stud has to be right—every feature *is*. It has strength, wear resistance, precision fit, true-ground spherical and tapered surfaces, close inspection and strict uniformity.

Brown Hardened and Ground Parts have been serving the automotive industry for over 40 years. We refer you to any of our long list of satisfied customers. For information pertaining to your own requirements, simply write or wire.

Harry W. Brown
PRESIDENT



Parts Include
King Pins
Shackle Bolts
Shackle Pins
Brake Anchor Bolts
Countershafts
Idler Shafts
Stub Axle Shafts
Steering Ball Bolts
Beam Bolts and Bolts
5th-Wheel Rocker Bolts
Wheel Studs
Water Pump Shafts
... anything in the
hardened and ground
line, of any analysis
steel, up to 4 1/4" diameter.

THE BROWN CORP.

213 BELLEVUE AVE.

SYRACUSE, N. Y.

C. H. Short, 3407 Cleveland Rd., Cleveland • N. F. Spring, 4716 Balfour Rd., Detroit • R. C. Robinson, 8509 N. Clark St., Chicago • Harry J. Wendenker, 1704 Carlton, East Worth • James Whitman & Co., 1440 N. Spring St., Los Angeles, Calif. • John S. Hunt, 2811 S.E. Yamhill St., Portland, Ore.

ASK

BAIRD

ABOUT IT!

HIGH PRODUCTION TOOLING

FOR REPETITIVE MANUFACTURE OF PARTS FROM COILED STOCK

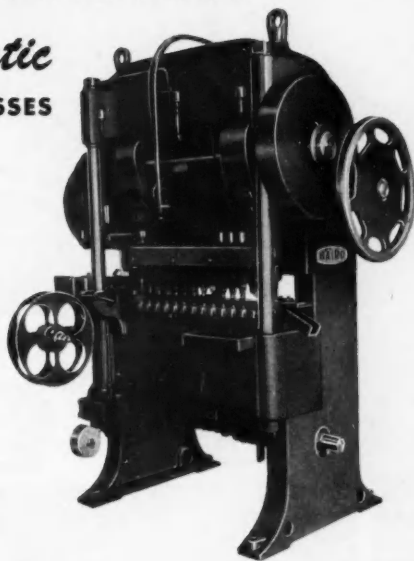
check

BAIRD *Automatic*

MULTIPLE TRANSFER PRESSES

Simply stated, this press combines, in a single cycle, operations that might otherwise require several smaller machines with an operator for each one.

There are so many varied tooling possibilities that it is impossible to enumerate them here. In ordinary operations the press automatically feeds coil stock for piercing, lettering, embossing, etc., then cuts the blank, places it in transfer fingers, moves it along to several other tool stations and ejects the finished piece. In addition, preformed material may be fed from the opposite end of press for many other operations . . . all completely automatic. A full set of tools (composed of punch and die blocks, their punches and dies, transfer slide and fingers) may be removed as a single unit . . . and a different set inserted, and in some instances without disturbing any adjustment . . . in a comparatively short time. Note the following example:



. . . a typical BAIRD tooling set-up



This is a complete die set with full complement of punches and dies in working position for the production of a special aircraft lock-nut . . . finished in one operation (14 stations). The transfer is in the loading position. After completion of stroke, work is pushed to transfer fingers by plungers operated by cams in back of and under the press. Production: 70 pieces per minute.

Full details of Transfer Press available in new bulletin . . . copy on request. Ask Baird about it!

the **BAIRD MACHINE COMPANY**
STRATFORD • CONNECTICUT

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING
MACHINES • AUTOMATIC PRESSES • TURNING BARRELS

TAKE THE **NADELLA** ROAD

IT'S THE ROAD TO SUCCESS...

THE
FAMOUS
ORIGINATORS
OF
NEEDLE CARTRIDGES
AND
NEEDLE BEARINGS
WITH NEEDLE RETAINERS

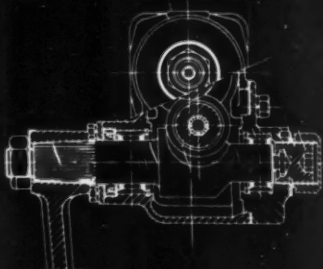
loose needles



needle cartridges



complete bearings



Steering gear



King pin (Front axle)

133 & 137 BOULEVARD NATIONAL

NADELLA

RUEIL-MALMAISON (S.O.) FRANCE

*Built
for*

MILITARY REQUIREMENTS

Redmond
MICROMOTORS

DYNAMOTORS

**WINDSHIELD WIPERS
AND OTHER SPECIAL
EQUIPMENT**



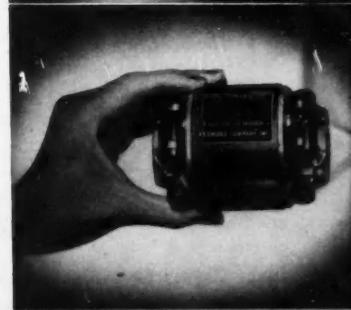
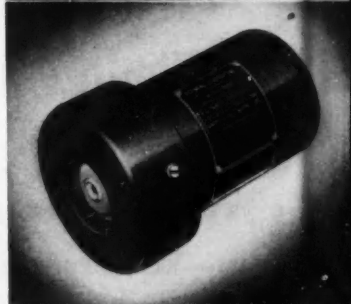
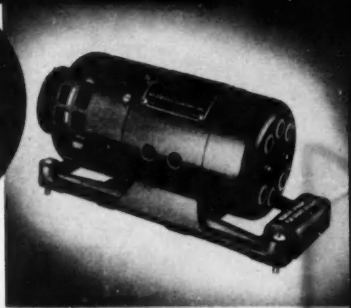
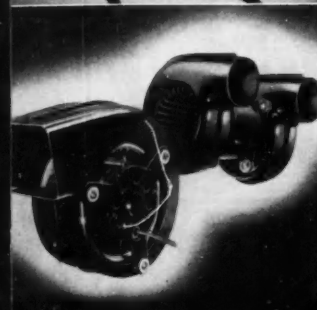
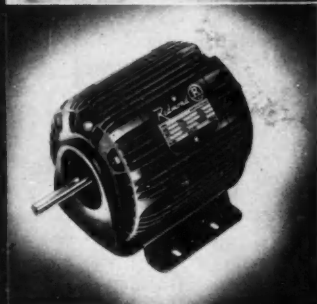
You can look to the efficient Redmond organization for the kind of cooperation you need in the development and manufacturing of military equipment. Here you also get capable engineering service keyed to high volume production techniques. At the Redmond Company you are served by an active team of 3000 thoroughly trained personnel.

More than 35,000,000 Redmond Micromotors, dynamotors and other products have been built for civilian and military use. Phone, or drop us a line today.

Redmond COMPANY, Inc.

THE BIG NAME IN SMALL MOTORS

REDMOND COMPANY, INC., Owosso, Mich., U.S.A. INDUCTION MOTOR SALES OFFICES: Eastern Area: 420 Lexington Ave., New York 17, N. Y.; Central Area: Owosso, Michigan; Midwest Area: 332 S. Michigan, Chicago 4, Ill.; Southwest Area: 1330 N. Industrial Blvd., Dallas, Texas; Western Area: (Redmond Company of Calif., Inc.) 1260 S. Boyle Ave., Los Angeles 23, Calif. SERIES MOTOR SALES OFFICES: Owosso, Mich. OVERSEAS SALES OFFICES: 420 Lexington Ave., New York 17, N.Y., cable address, REDISINC - NEW YORK.



**Another new development using
B. F. Goodrich Chemical Company raw materials**



*Mission
accomplished!*

**Hycar helps seal power
in—keep trouble out!**



PALMETTO #2913
Compressed Asbestos
Gasket Material (meets
Spec. MIL-G-7021 Class 1,
formerly AN-G-171 Class 1)
made by Greiner, Tivoli & Co.,
North Wales, Pa.

BEFORE that Navy helicopter was ever built, every part in it had to pass rigid performance tests—must have an ample margin of safety. The carburetor gasket pictured—made with Hycar—ran up a perfect score!

The gasket's job is to provide an air-tight seal . . . to keep fuel vapors in, and keep out oil and other substances that can cause carburetor trouble.

See how Hycar helps do this job so well. Hycar bonds the asbestos

fibers of the gasket material—resists heat, oil, solvents—retains its high tensile strength. It helps make the gasket non-absorbing, non-swelling, non-cracking.

Hycar has advantages that make it ideal for many defense and civilian uses. It resists oil, gas, abrasion, weather and wear—and more hard-to-meet conditions. Demand for Hycar materials exceeds present supplies, but limited quantities are available for development work. For technical bulletins, advice, please

write Dept. HD-7, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco.

B. F. Goodrich Chemical Company
A Division of The B. F. Goodrich Company

Need extreme temperature resistance?
Hycar has it—plus abrasion resistance
and more advantages.

Hycar
Reg. U.S. Pat. Off.
American Rubber

GEON polyvinyl materials • Hycar American rubber • GOOD-RITE chemicals and plasticizers
HARMON organic colors



Great Dane bulk orange trailer built by Steel Products Co., Inc., Savannah, Georgia. Mayari R low-alloy, high-strength steel is used in the construction of these specially designed units.

TRAILER CARRIES MORE ORANGES ...REQUIRES LESS STEEL

Designed to haul bulk oranges from groves to canning plants in Florida, this monocoque trailer shows how Mayari R low-alloy, high-strength steel can be used to advantage in a special-purpose vehicle.

All of the structural members and the tailgate assembly are made of Mayari R to reduce deadweight. Because of its higher yield-point, light-gage sections of Mayari R could be used instead of heavier

sections of carbon steel. As a result, less steel is required, and the payload capacity of the trailer is increased 2500 lbs without adding to the axle loads.

The builder uses Mayari R to fabricate the cold-formed side posts and bottom cross-members. Projection-welding is used throughout.

Builders of many different types of trailers and truck bodies are using this high-strength, weight-

saving steel to increase the efficiency of their vehicles. Experience has shown that Mayari R often makes possible worth-while improvements in design and longer life at only a slight increase in the cost of materials.

Further information on the use of Mayari R is available for the asking. Write or phone for a copy of Catalog No. 259.

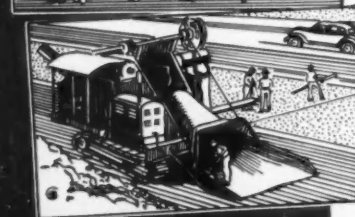
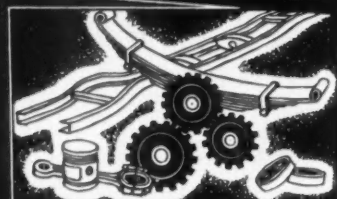
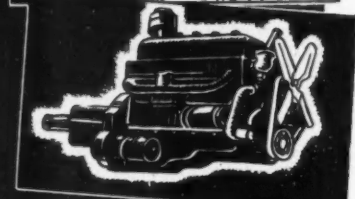
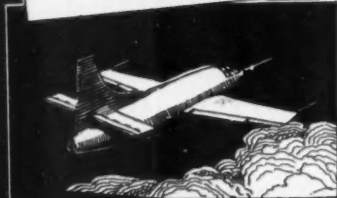
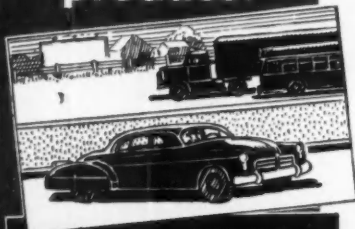
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation



Mayari R *makes it lighter... stronger... longer lasting*

The
automotive
industries
produce:



What do the automotive industries purchase?

Answer:

Annually, billions of dollars worth of parts, materials, machine tools, supplies, farming presses, plant equipment, services . . .

AN \$8 BILLION ORDER FOR AMERICAN INDUSTRY

During 1949, the automotive industries wrote out an \$8 billion purchase order for American manufacturers and suppliers to fill. Large scale buying must be done to maintain top production of cars, trucks, buses, tractors, aircraft, engines, parts, accessories, automotive materials and equipment, farm and road-working implements.

THOUSANDS OF SUPPLIERS INVOLVED

A typical, medium-sized automotive manufacturer buys from 7300 suppliers, who furnish 70,000 different kinds of items, varying from raw materials and production equipment to parts and materials—from abrasives to zinc. Automotive firms spend well over half of their total dollar receipts for supplies!

HOW TO GET YOUR SHARE OF THIS MARKET

AUTOMOTIVE INDUSTRIES magazine reaches and influences *23,000 proved readers in 3118 automotive manufacturing plants from coast to coast. It is the industries' ONLY magazine that provides full coverage of new automotive design, production and industry developments. (A.B.C. circulation, 12,157 . . . subscription renewal rate, 82.55%!)

*From Advertising Research Foundation Business Paper Study #1.

AUTOMOTIVE INDUSTRIES

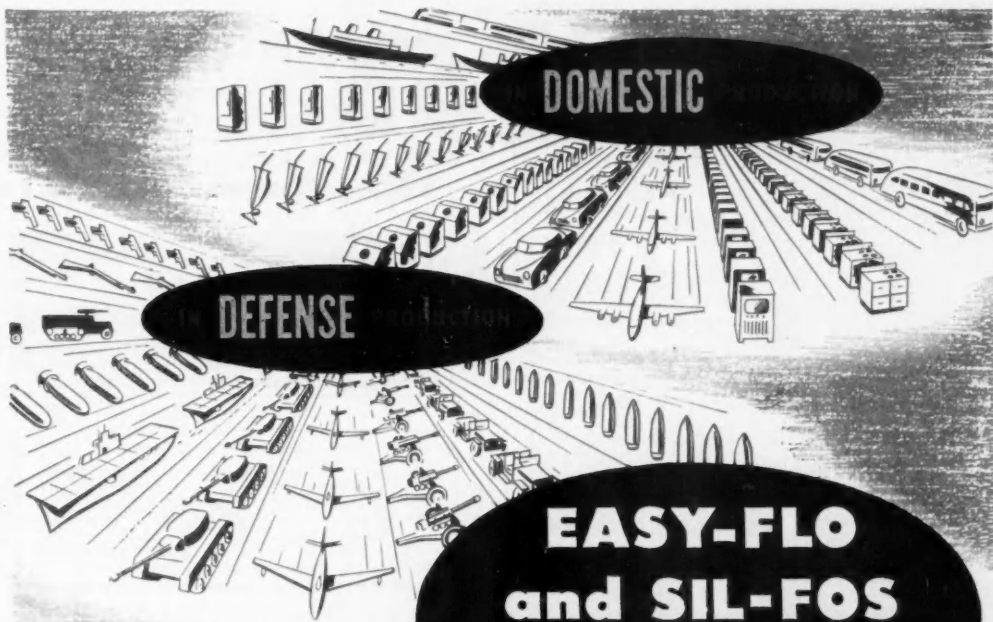
Chestnut and 56th Sts.
Philadelphia 39, Pa.



A CHILTON Publication

**AUTOMOTIVE
INDUSTRIES**

... the industrial automotive NEWS MAGAZINE



DOMESTIC

DEFENSE

**EASY-FLO
and SIL-FOS**
mean Fast production



**Get any brazing output you need with
the ALLOY PREPLACEMENT formula.**

The girl in the picture above easily brazes 33 gas meter part assemblies per hour—every one gas-tight and with one-piece strength. It's a typical example of the alloy preplacement formula in action—the formula that makes brazing as simple

as abc and assures a steady stream of soundly brazed parts. Get the full story about this time, labor, cost-saving formula in **BRAZING NEWS No. 54**. Write for a free copy today.



Once again these low-temperature silver brazing alloys are doing *double-duty*—helping American Industry meet the biggest two-front production order in history—defense and domestic.

Once again EASY-FLO and SIL-FOS are proving a godsend in enabling manufacturers on both fronts to turn out strong, leak-proof metal joints at *amazing production rates and with push-button simplicity*—and, as a natural result, at rock-bottom costs.

Once again all Handy & Harman's resources are being exerted to help manufacturers get the utmost benefit of the remarkable speed and economy inherent in EASY-FLO and SIL-FOS brazing.

USE THIS VALUABLE SERVICE

Without cost or obligation, we'll send to your plant one of our corps of specially trained and widely experienced field service engineers to help you determine *where* and *how* EASY-FLO and SIL-FOS will simplify, improve, and speed up your metal joining. Just contact our nearest office or agent and say when you'd like him to call.

HANDY & HARMAN

82 FULTON STREET • NEW YORK 38, N. Y.

Bridgeport, Conn. • Chicago, Ill. • Los Angeles, Cal.

Providence, R. I. • Toronto, Canada

Agents in Principal Cities



SHIP
IN
SAS

AIR CARGO TO EUROPE OVERNIGHT!

The swift, reliable "high-way" to all Europe—plus the Near and Far East. 12 hours to Britain, overnight to 6 German cities, daily to Central Europe.

• SAS GROUND-HANDLING, system-wide, means rapid, safe forwarding.

special reduced rates on auto parts to most destinations

See Your
Air Cargo Agent

SCANDINAVIAN
AIRLINES SYSTEM

The General Radiator Company,
the biggest little radiator company
in the business, offers you

1. Highest Quality Radiators
2. Dependable Engineering Service
3. Best Delivery
4. Lowest Prices

General's exclusive air foil fin and large tube has built up a splendid reputation in the heavy-duty industrial radiator field.

GENERAL RADIATOR COMPANY
Marion, Illinois



DROP-FORGINGS

ANY SHAPE • ANY MATERIAL • COMPLETE FACILITIES

Write for Free Forging Data Folder . . . Helpful, Informative
J. H. WILLIAMS & CO., "The Drop-forging People" BUFFALO 7, N. Y.

Over 20 Years Experience

BUS and TRAILER PARTS

License Plate Holders (large and small)
Ventilators, Ventilator Grills (inside and outside control)

Marker Lights (large and small)

DIES and STAMPINGS

Quality Dies from the smallest up to 2000 lbs.
Quality Stampings 225 ton capacity, 5 7/8 in. draw

THE **HP** DIE and STAMPING CO.

13943 TRISKETT ROAD • CLEVELAND 11, OHIO



RAILS *New and Relaying!*

TRACK MATERIALS
AND ACCESSORIES CARRIED IN STOCK
Switch Material • Spikes and Bolts • Track
Tools • Ties • Tie Plates • Bumpers •
Complete Side Tracks

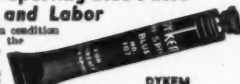
BUILDERS STEEL SUPPLY CO.
4201 WYOMING, P.O. BOX 180 • DEARBORN, MICH.



Automatic ENGINE
CONTROLS
SYNCHRO-START PRODUCTS, INC.
8151 N. RIDGEWAY AVE., SKOKIE, ILLINOIS
See our full page "ad" in the STATISTICAL ISSUE p. 187

A NON-DRYING High-Spotting Blue Paste Saves Time and Labor

As it does not dry out, it remains in condition to work indefinitely, hence saves the scraper's time. Intensely blue paste can be spread thick; transfers clearly 500 per tube, 45¢, 3 or more. Ask your dealer, order from this Ad, or write for FREE Trial Tube!



DYKEM
HI-SPOT BLUE NO. 187

The DYKEM CO., 23011 North 11th St., St. Louis 8, Mo.

PIPE PLUGS *Exclusively*



Steel • Cast Iron
Malleable Iron



MACHINE PRODUCTS CO.
INC.

Pittsburgh 15, Pa.

Evans City, Pa.



BESLY-TITAN ABRASIVE WHEELS

Made to Meet Your Individual Production Requirements

The Bealy man in your territory may be able to show you how to get a better finish, closer tolerance, increased output, lower costs—or all four. Write us.

CHARLES H. BESLY CO., 118 North Clinton Street, Chicago 4, Illinois



QUALITY STAMPINGS



Heavy, medium and light stampings in any quantity.
A steady flow of production . . . when you want it.

WORCESTER STAMPED METAL CO., 9 HUNT STREET, WORCESTER, MASS.

BUY BONDS



AUTOMOTIVE INDUSTRIES, July 1, 1951

NOW!

A BETTER WAY TO APPLY
COATINGS, SEALERS, ADHESIVES

Works ANYWHERE... From

CAR BOTTOMS TO ROOF TOPS



• Here's the faster, low-cost way to apply sound-densifying materials on automobiles... to put gummy roofing materials on roof tops... or to handle scores of other materials ranging from heavy mastics to light fluids.

Graco Powerflo Pumps have hundreds of industrial uses. Powerflo makes easy work of applying coatings, sealers and adhesives... does spraying and calking jobs faster, more economically.

NO TRANSFERRING—Pumps direct from original container. No pressure pots, no transferring. Double-acting piston assures high-volume delivery. Pump units for full-size drums or 5 gal. pails. Includes spray pole, or extrusion gun.

Write and tell us your application problem... if Powerflo can help you, we'll send detailed information at no obligation to you. Free catalog also available.

GRACO COMPANY, INC.
72 Graco Square, Minneapolis, Minnesota

GRACO Powerflo Pumps

District offices in Detroit, New York, Philadelphia, Chicago, San Francisco

Handiest Location in PITTSBURGH

Hotel Pittsburgher
PITTSBURGH, PA.



Right in the heart of town

Make the PITTSBURGH your stopping place on every motor trip. Located right in the heart of town... easily reached from all major highways. Enjoy the finest in modern facilities, too... 400 rooms each with free radio, bath and circulating ice water. Garage service.

a Knott Hotel

JOSEPH F. DUDY, MANAGER

1779

AUTOMOTIVE INDUSTRIES, July 1, 1951

ABBOTT BALLS

do the job

right

HERE



Abbott Bearing Balls, used in hinges and butts, make the frequently-used doors on refrigerators, vaults and industrial buildings swing freely, silently, effortlessly. Every Abbott Ball — DEEP HARDENED with a mirror-like, glass hard finish — is shock resistant and performs efficiently under high load factors.

New catalog-manual gives full information on all Abbott products. Send for your copy today.

Use Abbott... the all round ball.

ABBOTT

THE ABBOTT BALL COMPANY
35 Railroad Place, Hartford 10, Conn.

Thousands of users know FITZGERALD

Metallic Aluminum-
Fused-Oxide Steel Asbestos

GASKETS*

and costly
gasket failures

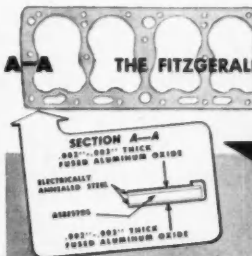
Specially designed,
ruggedly built, to
give a lasting,
perfect seal in high
compression engines,
gasoline or diesel.

There's a Fitzgerald
Gasket for Every Engine

Grease Retainers

Cork Gaskets

FITZ-Rite Treated Fiber
Gaskets for oil, gasoline
and water connections



THE FITZGERALD MANUFACTURING CO.

Torrington, Connecticut

*Service Mark Registration Pending

FITZGERALD
gaskets
SINCE 1906

121

Index to

The Advertisers' Index is published of the advertising contract. Every rectly. No allowance will be made

Abbott Ball Company, The ..	121	Brandt, Inc., Chas. T.	—	Fairfield Mfg. Co.	—
Acadia Div. Western Felt Works	10	Brown Corp., The	112	Federal-Mogul Corp.	—
Accurate Bushing Co.	88	Buckeye Tools Corp.	82	Fellows Gear Shaper Co., The ..	26-27
Accurate Spring Mfg. Co.	30	Builders Steel Supply Co.	120	Fitzgerald Mfg. Co., The ..	121
Acushnet Process Company ..	72	Bullard Company, The	—	Foot-Burt Company	—
Aerquip Corp.	124	Bundy Tubing Company	—	Fram Corp.	—
Aetna Ball & Roller Bearing Co.	—	Burdett Mfg. Co.	—	Fuller Manufacturing Co.	—
Ajax Manufacturing Co., The	—	Burlington Mills, Inc.	—		
Allegheny - Ludlum Steel Corp.	—	C. A. V. Division of Lucas Electrical Services, Inc.	98	G & O Mfg. Co., The	124
Allied Products Corp.	111	Campbell, Wyant & Cannon Foundry Co.	—	Galland-Henning Mfg. Co.	—
Aluminum Alloys Corp.	100	Carboloy Company, Inc.	—	Garrett Co., Inc., Geo. K.	—
Aluminum Co. of Amer.	124	Carborundum Company	13	General Controls	—
Aluminum Industries, Inc.	—	Carnegie-Illinois Steel Corp.	—	General Electric Company	—
American Bosh Corp.	—	Central Screw Co.	—	General Radiator Co.	120
American Broach & Machine Co.	—	Centrifugal Foundry Co.	—	Gibson Co., Wm. D.	—
American Chain & Cable Co.	—	Chambersburg Engineering Co.	—	Gits Bros. Mfg. Co.	—
American Chemical Paint Co.	—	Chicago Rivet & Machine Co.	—	Globe-Union, Inc.	—
American - Fort Pitt Spring Div. H. K. Porter Company, Inc.	86	Chicago Screw Co., The	—	Goodrich Chemical Co., B. F.	116
American Hard Rubber Co.	—	Chilton Co. (Direct Mail)	124	Gray Co., Inc.	121
American Steel & Wire Co.	—	Cincinnati Cleaning & Finishing Co.	—	Great American Industries, Inc., Rubatex Div.	—
Anchor Plastics Co., Inc.	—	Cincinnati Milling Machine Co.	16	Great Lakes Steel Corp.	—
Anderson Co., Inc., O. L.	—	Clark Equipment Co.	—	Greenlee Bros. & Co.	—
Armstrong Cork Co.	7	Clearing Machine Corp.	—	Gries Reproduce Corp.	—
Associated Spring Corp.	—	Cleco Div. Reed Roller Bit Co.	—	Groov-Pin Corp.	—
Auto Specialties Mfg. Co.	—	Cleveland Punch & Shear Wks. Co., The	84	Gunite Foundries Corp.	—
Automatic Spring Coiling Co.	—	Cleveland Tapping Machine Co., The	—		
Automotive Gear Works, Inc.	—	Climax Molybdenum Co.	108	H & P Die & Stamping Co.	120
Automotive Industries	118	Colonial Broach Co.	—	Handy & Harman	119
		Columbia Steel Company	107	Hannifin Corp.	—
		Columbus Coated Fabrics Corp.	—	Hanson-Whitney Company ..	101
Babeock & Wilcox Tube Co.	—	Cone Automatic Machine Co.	—	Harrison Radiator Division ..	—
Bacharach Industrial Instrument Co.	—	Continental-Diamond Fibre Co.	—	Hartford Steel Ball Co., The ..	92
Baird Machine Co., The	113	Continental Motors Corp.	—	Heald Machine Co., The	—
Baldwin - Lima - Hamilton Corp.	—	Continental Screw Co.	—	Herbrand Division, The Bing-ham-Herbrand Corp.	—
Barber-Colman Company	—	Continental Tool Works Div.	77	Hercules Powder Company	—
Barnes Co., Wallace	—	Cotté Transmission Co.	1	Hill Acme Company, The	—
Barnes, W. F. & John	31	Cross Company, The	12	Holcroft & Co.	104
Barnes-Gibson-Raymond	—	Cummins Engine Co., Inc.	—	Holley Carburetor Co.	—
Bath Co., The, Cyril	—	Danly Machine Specialties, Inc.	73	Hoof Products Co.	—
Bauer & Black Div., Kendall Co.	—	Davis & Thompson Co.	—	Hotel Pittsburgher	121
Bear Mfg. Co.	—	Detroit Aluminum & Brass Corp.	—	Houghton & Co., E. F.	—
Bell Aircraft Corp.	—	Detroit Harvester Company ..	91	Howell Electric Motors Co.	—
Bendix Aviation Corporation ..	—	Direct Mail Div. Chilton Co.	124	Hyatt Bearings Div.	—
Bendix Products Div.	14	Disston & Sons, Inc., Henry ..	—	Hy-Pro Tool Co.	—
Eclipse Machine Div.	—	Dole Valve Co., The	—		
Scintilla Magneto Div.	—	Donaldson Co., Inc.	—	Illinois Tool Works	—
Stromberg-Elmira Div.	—	Dow Corning Corp.	—	Indiana Gear Works	—
Zenith Carburetor Div.	29	Dreis & Krump Mfg. Co.	—	Inland Manufacturing Div.	—
Bendix - Westinghouse Automotive Air Brake Co.	—	Dunbar Brothers Co.	—	Inland Steel Company	—
Besly Co., Chas. H.	120	du Pont de Nemours & Co., Inc., E. I.	—	International Nickel Co., Inc. ..	2
Bethlehem Steel Co.	117	Dykem Co., The	120		
Black & Decker Mfg. Co., The ..	—	Dynamatic Corp. Sub. of Eaton Mfg. Co.	8	Janitrol Surface Combustion Corp.	—
Blakeslee & Co., G. S.	70			Johnson Bronze Co.	—
Bliss Company, E. W.	—	Eaton Manufacturing Co.	93	Johnson Products, Inc.	—
Blood Bros. Machine Co.	103	Elastic Stop Nut Corp.	71	Justrite Mfg. Co.	—
Bodine Corporation, The	97	Elco Tool & Screw Corp.	—		
Borg & Beck Div.	—	Electric Auto-Lite Co., The ..	—	Kelsey-Hayes Wheel Co.	—
Borg-Warner Corp.	—	Electric Furnace Co., The	—	Kennedy Car Liner & Bag Co., Inc.	—
Bound Brook Oil-Less Bearing Co.	—	Electric Storage Battery Co.	9		
		Ex-Cell-O Corp.	77		

Advertisers

as a convenience, and not as part
care will be taken to index cor-
for errors or failure to insert.

Kent-Owens Machine Co.	—	Page Steel & Wire Div., Amer.	—	Sterling Aluminum Products,	61
Kester Solder Co.	—	Chain & Cable Co., Inc.	—	Inc.	—
King-Seeley Corporation	—	Palnut Company, The.	—	Stewart-Warner Corp.	—
Kropp Forge Company	—	Pangborn Corp.	—	Strom Steel Ball Co.	76
		Parker Rust Proof Co.	67	Stuart Oil Co., Ltd., D. A.	—
		Pedrick Piston Rings.	—	Sturtevant Co., P. A.	—
		Perfect Circle Corp.	63	Subscription Post-Card	—
		Perma Products Co.	—	Sun Electric Company	—
		Pesco Products Div. Borg-	—	Sun Oil Company	—
Lake Erie Engineering Corp.	—	Warner Corp.	—	Sundstrand Machine Tool Co.	—
Lamb Electric Company	—	Pheoll Manufacturing Co.	—	Superior Steel Corp.	—
Layne & Bowler, Inc.	108	Physicists Research Co.	—	Surface Combustion Corp.	—
Leece-Neville Co., The	80	Pierce Governor Co., Inc.	—	Synchro-Start Products, Inc..	120
Leeds & Northrup Co.	—	Pines Engineering Co., Inc.	—	Tennessee Coal, Iron & R. R.	—
Leland, Inc., G. H.	—	Plaskon Div.	—	Co.	—
Le Roi Company	—	Plastic Research Products Co.	78	Texas Company, The	4
Link-Belt Co.	5	Polk & Co., R. L.	110	Thompson-Bremer & Co.	—
Lipe-Rollway Corp.	—	Polyken Industrial Tape.	—	Timken Roller Bearing Co.,	—
Littlefuse, Inc.	—	Potter & Johnston Co.	65	The	—
Littell Machine Co., F. J.	—	Pratt & Whitney Div., Niles-	—	Tinnerman Products, Inc.	—
Long Manufacturing Div.	—	Bement-Pond Company	—	Tomkins - Johnson Company,	—
Lord Manufacturing Co.	—	Purolator Products, Inc.	—	The	—
		Ramsey Corporation.. Back Cover	—	Torrington Co., The	—
McKay Machine Co.	—	Rathborne, Hair & Ridgway	—	Tourek Mfg. Co., J. J.	—
Machine Products Co., Inc.	120	Box Co.	—	Towmotor Corp.	—
Magnaflux Corp.	—	Raybestos-Manhattan, Inc.	—	Twin Sol Lamp Works, Inc. ..	—
Magnecord, Inc.	85	(Equipment Sales Div.)....	—	Tuthill Pump Co.	—
Mahon Co., The R. C.	109	Raymond Mfg. Co.	—	Tuthill Spring Co.	66
Maish Co., Chas. A.	—	Redmond Company, Inc.	115	Twin Disc Clutch Co.	—
Mallory & Co., Inc., P. R.	—	Reeve Electronics, Inc.	—	United Engine & Machine	—
Manross & Sons Co., F. N.	—	Remont Mfg. Co.	—	Co.	74-75
Markem Machine Co.	—	Revere Copper & Brass, Inc.	—	United Specialties Company..	106
Marman Products Co., Inc.	—	Reynolds Wire Div.	—	United States Rubber Co.	—
Mattison Machine Works	—	Richards Co., J. A.	—	United States Steel Corp.	107
Mechanics Universal Joint Div.	—	Rigidized Metals Corp.	102	United States Steel Wire	—
Michigan Tool Company	—	Finished-Mason Company	—	Spring Co.	—
Micromatic Hone Corp.	69	Rockford Clutch Div.	—	Universal Products Co., Inc..	87
Midland Steel Products Co.,	90	Ross Gear & Tool Co.	—	Vanadium Corp. of Amer.	—
The	—	Rubatex Div., Great American	—	Vellumoid Co., The	—
Miller Motor Co.	—	Industries, Inc.	—	Verson Allsteel Press Co.	—
Milco Manufacturing Co.	—	Russell, Burdsall & Ward Bolt	—	Vickers, Inc.	—
Milwaukee Div.	—	& Nut Co.	—	Victor Manufacturing & Gas-	—
Minneapolis-Honeywell Regu-	—	Ryerson & Son, Inc., Joseph T.	—	kett Co.	—
lator Co.	—	—	—	Vulcan Rubber Products, Inc..	—
Minnesota Mining & Mfg. Co.	—	SKF Industries, Inc.	6	Wagner Electric Corp.	—
Moline Tool Co.	—	Saginaw Steering Gear Div.	—	Waldes-Kohinoor, Inc.	—
Monarch Machine Tool Co.	—	Scandinavian Airlines System.	120	Waukesha Motor Company ..	—
Moraine Products Div.	—	Schmieg Industries, Inc.	—	Wean Equipment Corp.	—
Morse Chain Co.	—	Schwitzer-Cummins Co.	59	Webb Co., Jervis B.	—
Motch & Merryweather Ma-	—	Sealed Power Corporation.	—	Wellman Bronze & Aluminum	—
chinery Co.	—	Seneca Falls Machine Co.	11	Co., The	—
Muskegon Piston Ring Co.	—	Service Spring Co.	—	Western Felt Works	10
		Set Screw & Mfg. Co.	—	Westinghouse Electric Corp.	94-95
N-A-X Alloy Division.	—	Shakeproof, Inc.	—	Wheland Company, The	—
Nadella	114	Shuler Axle Co., Inc.	—	Wilkens Mfg. Co.	—
Nash Bros. Company.	—	Sibley Machine & Foundry	—	Williams & Co., J. H.	120
National Acme Co., The.	81	Corp.	68	Wisconsin Motor Corp.	—
National Broach & Machine Co.	—	Simonds Abrasive Co.	—	Wittek Mfg. Co.	110
National Machinery Co.	79	Snyder Tool & Engineering	—	Worcester Stamped Metal Co.	120
National Motor Bearing Co.	—	Co.	89	Wrought Washer Mfg. Co.	—
National Steel Corporation.	—	Spicer Mfg. Div. Dana Corp.	99	Wyman-Gordon	—
National Tube Company.	107	Stalwart Rubber Co., The	—	Yale & Towne Mfg. Co., The..	—
New Britain Machine Co.	28	Standard Oil Co. (Ind.) 2nd Cover	—	Yates-American Machine Co..	—
New Departure Div.	—	Standard Pressed Steel Co.	83	Young Radiator Company ...	3
Niagara Machine & Tool Wks.	—	Standard Tube Company	96	Zollner Machine Works	—

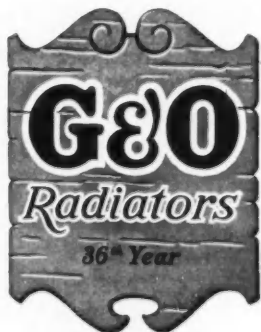
3rd Cover



From design help to on-schedule completion, Alcoa die-casting facilities are noted for dependability . . . in submitting bids promptly . . . in meeting or beating specifications. Backed by 63 years of aluminum experience, staffed by "old hands" at aluminum die casting, Alcoa's great plants offer unmatched facilities for making your die castings.

For details, see your local Alcoa representative, listed under "aluminum" in your classified phone book. Or write: ALUMINUM COMPANY OF AMERICA, 1903G Gulf Building, Pittsburgh 19, Pa.

ALCOA *Aluminum*
DIE CASTINGS



ENGINE COOLING RADIATORS

HEATERS

OIL COOLERS

THE G&O MANUFACTURING CO.
NEW HAVEN CONNECTICUT

Aeroquip

FLEXIBLE HOSE LINES
and DETACHABLE FITTINGS



1. Reduce inventory.
2. Reduce expensive downtime.
3. Permit you to salvage old hose lines.
4. Make possible immediate repair of hose line failures.
5. Eliminate the need for factory assembled hose lines.
6. Permit you to make hose lines to desired length as required.
7. Permit you to replace rigid tubing failures on the spot.
8. Eliminate the need for rigid tubing forms and jigs.
9. Permit you to make hose lines for mock-up installations rapidly.

AEROQUIP CORPORATION
JACKSON, MICHIGAN

FLEXIBLE HOSE LINES • DETACHABLE, REUSABLE FITTINGS • SELF-SEALING COUPLINGS • BREAKAWAY COUPLINGS • HYDRAULICSCOPE
AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A. AND ABROAD

DIRECT MAIL USERS:
*here's the vital LINK
between*

YOUR
COMPANY

and 33,000 Key
**AUTOMOTIVE
EXECUTIVES**

... the **CHILTON**
INDUSTRIAL AUTOMOTIVE MAILING LIST

Authoritative . . . daily-corrected . . . personalized. The only authentic list covering the buying power of the \$14 billion automotive manufacturing field.

Chilton offers COMPLETE direct mail service, including selective addressing by types of executive and product. Write for more information, to . . .

DIRECT MAIL DIVISION
CHILTON COMPANY

Chestnut & 56th Sts., Phila. 39, Pa.



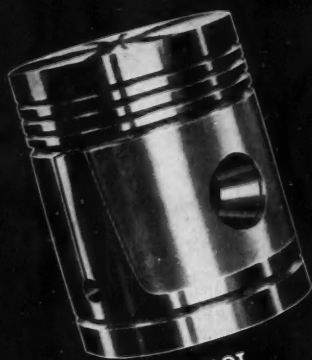
AUTOMOTIVE HEADQUARTERS

**ENGINEERING
COOPERATION
PRODUCTION
"KNOW-HOW"**

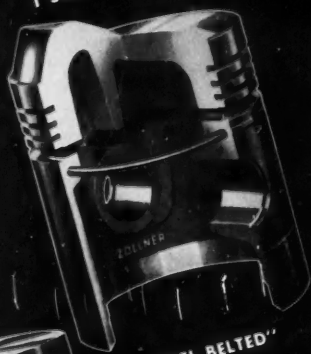


PISTONS

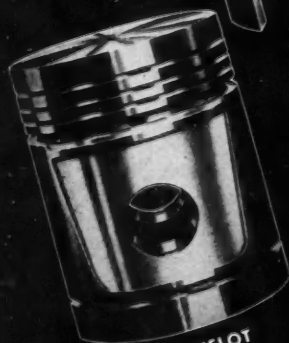
**EXPERTLY DESIGNED
PRECISION-MADE**
Specifically for Your
**GASOLINE
ENGINE**



T SLOT



"STEEL BELTED"



TRANSLOT

*Original Equipment in
America's Finest Motors*

WAUKESHA	IHC
GMC	CONTINENTAL
HERCULES	HALL-SCOTT
ENGINES	SEAGRAVE
CORBITT	BUDA
FWD	FEDERAL
DIAMOND-T	MARMON-
TWIN COACH	HERRINGTON
REO	CUMMINS
MACK	

ZOLLNER

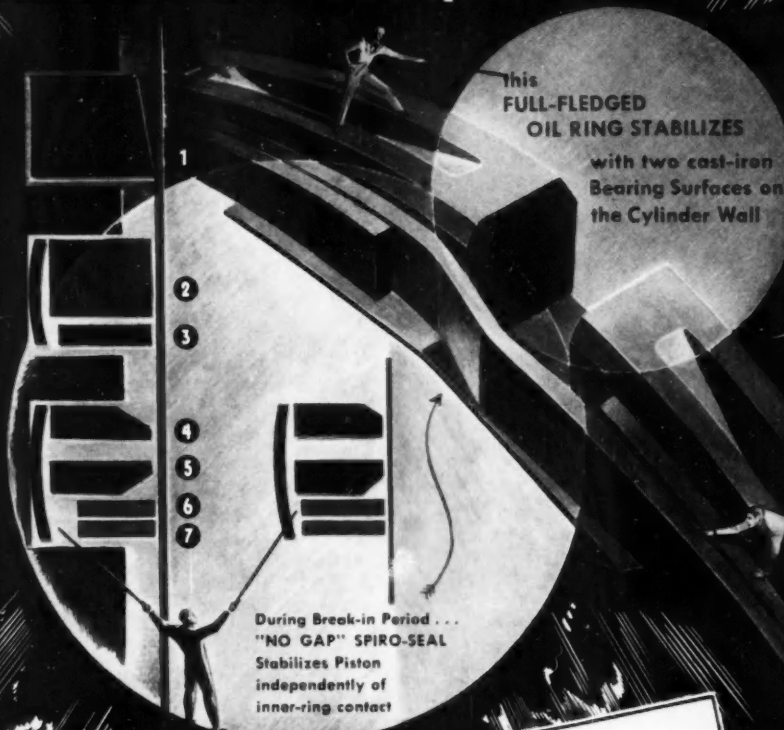
PISTON EQUIPMENT

for **INTERNAL COMBUSTION ENGINES
— BOTH GASOLINE AND DIESEL**

ZOLLNER MACHINE WORKS, FORT WAYNE, IND.

"Makes Any Engine a Better Engine"

Stabilization *instead of wall pressure*...



of interest to engineers

Memo

SUBJECT: Consideration of the wear factor in Piston Ring Design

Curbing wear of cylinder walls has always been a major concern of piston ring designers. Here at Ramsey it is a factor that is never lost sight of by the Engineering Group.

One of the major principles employed by Ramsey in the interest of curbing cylinder-wall wear is the utilization of cast-iron contact surfaces. It is well-known to automotive engineers that the soft, graphitic content of cast-iron acts as a lubricant when it contacts a harder surface.

Ramsey Ring Design puts the cast-iron principle to work to insure proper preparation of the cylinder walls. Stabilization, rather than wall pressure to control oil and blow-by, is one of the reasons why it is possible for Ramsey to utilize this principle. Another is that, even though steel is used, it is employed as a secondary bearing surface, instead of a primary one.

We have found that the proper preparation of cylinder walls is one of the essentials to longer ring life and maximum curbing of the wear factor.

We welcome your inquiry regarding this and additional wear-curbing principles employed by the Ramsey Piston Ring Design, and how this design may be of use to you for original equipment, replacement or other purposes.

RAMSEY CORPORATION
General Offices, St. Louis, Missouri

Illustrating the utilization of cast-iron bearing surfaces in a ring designed for replacement purposes.